

PROJECT MANUAL

1161 West Samford Ave. Facilities Complex
**Facilities Building Eight – New Facility for Waste
Reduction, Mail Services & Service Support**

**Auburn University Project No. 13-194
Kahn Project No. 03322-00**



AUBURN

UNIVERSITY

Bid Set
January 30, 2015

FACILITIES MANAGEMENT SAMFORD AVENUE
AUBURN UNIVERSITY, ALABAMA 36849-5515
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Set No. _____

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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

SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

1. PRE-BID UTILITIES COORDINATION: The successful bidder, to whom the project is awarded shall be solely responsible for contacting ALL local utility service agencies (University/private/public/municipal) PRIOR to bidding to determine the scope of modifications, if any, to all utilities on site of work or adjacent to site in right-of-ways or easements due to work scope of this project. The Contractor shall make arrangements for, and pay all costs for modification, relocation or abandonment of existing utilities/services as required. Bidders may contact Auburn University, Facilities Management Maintenance and Operations, Utilities Records Department (334) 844-9410 for information regarding those utilities owned by Auburn University.

2. PRE-BID OBSERVATION: Bidders shall visit the site and become familiar with the existing conditions, facilities, project requirements and project site. Bidders may schedule a visit to the site with the Owner's Representative, up to three (3) working days prior to bid.

3. ATTACHMENTS TO PROPOSAL FORM: NAMING OF SUBCONTRACTORS AND SUPPLIERS, UNIT PRICES. When required / included in these documents, all attachments shall be submitted with the proposal unless otherwise stipulated. The Contractor must utilize those subcontractors and suppliers named, unless he can demonstrate to the Owner's satisfaction a compelling reason to change any of those named. For each subcontractor or supplier required on the proposal attachment(s), bidders shall name one and only one entity. In cases where alternates potentially change the "low" sub or supplier, bidders shall include names for "low" subs and suppliers at "Base Bid" unless otherwise stipulated.

Where the technical specifications require the use of a specialty subcontractor, (or other term which means a firm or company who is currently engaged in that trade as their primary work trade), one must be named on the attachment and employed on the project at no additional cost to the Owner.

Should the prime contractor bidder be one who regularly performs one or more of the specialty trades / subcontracts with its own forces, the prime contractor bidder may list itself, provided it can demonstrate without question to the Owner and the Architect that it performs this specific trade / specialty on a regular basis, utilizing skilled, experienced tradespersons who are on the full time payroll of the prime. Further, the prime must submit proof that it has completed a substantial (ten or more) number of similar projects, requiring similar specialty trades during the past two years, using its own forces. (Refer to the General Conditions for other requirements)

4. ADDITIONAL SUBMITTALS WITHIN 24 HOURS OF RECEIPT OF BIDS:

The apparent low bidder shall submit to the Owner and the Architect a complete list of all subcontractors, with their State of Alabama (Sub) Contractor's license numbers, and all materials suppliers for subcontracts and/or materials purchases in excess of \$50,000.00. This is in addition to the attachments referenced in paragraph 4 of these Supplemental Instructions to Bidders, which must be submitted with the proposal at the time of bid. All clarifications to the list of subs

submitted with the proposal must be submitted and described in detail in this “within 24 hours” submittal (items such as changes of Subs due to alternates, etc.).

The apparent low bidder shall submit to the Owner and the Architect a preliminary cost breakdown / schedule of values which shows the approximate cost for each section of work /trade / subcontract. A final schedule of values will be required as described in the General Conditions.

5. ADDITIONAL SUBMITTALS WITHIN 48 HOURS OF RECEIPT OF BIDS:

In order to prevent delay in contract award, the apparent low bidder must submit an approved Insurance certificate to the Owner within forty-eight (48) hours after bid. For each day delay in submitting the approved Insurance certificate a day will be deducted by change order from the contract duration.

6. ADDITIONAL SUBMITTALS WITHIN 10 DAYS OF THE CONTRACT AWARD:

For contracts in excess of \$5,000.00, the Contractor awarded the contract shall submit within ten (10) days of the award a copy of the State of Alabama Disclosure Statement required by Act 2001- 955. A copy of the Disclosure Statement is included herein as Form C-5A- Attachment A to Construction Contract.

The Prime Contractor shall submit a site specific safety plan (“Site Safety Plan”) in accordance with Auburn University Safety Specification to the Auburn University Project Manager within ten (10) days of AU notification of low apparent bidder.

7. SALES TAX

This project is exempt from Sales Tax in accordance with Act 2013-205. Contractor’s bids are not to include Sales Tax on materials (tangible personal property) to be incorporated into this project that are allowed by this Act. Currently excluded items are materials for highway, road or bridge work.

8. AWARD OF CONTRACT

No bid may be withdrawn after the scheduled closing time for receipt of bids for a period of sixty (60) days. The Owner reserves the right to reject bids if such action is determined to be in the best interest of the Owner.

9. BID GUARANTY

When the bid amount is less than \$50,000.00, no bid bond security is required. A bid bond is not required when the bid amount is less than \$50,000.00.

10. CERTIFICATION PURSUANT TO ACT NO. 2006-557

ALABAMA LAW (SECTION 41-4-116, CODE OF ALABAMA 1975) PROVIDES THAT EVERY BID SUBMITTED AND CONTRACT EXECUTED SHALL CONTAIN A CERTIFICATION THAT THE VENDOR, CONTRACTOR, AND ALL OF ITS AFFILIATES THAT MAKE SALES FOR DELIVERY INTO ALABAMA OR LEASES FOR USE IN ALABAMA ARE REGISTERED, COLLECTING, AND REMITTING ALABAMA STATE AND LOCAL SALES, USE, AND/OR LEASE TAX ON ALL TAXABLE SALES AND LEASES INTO ALABAMA. **BY SUBMITTING THIS BID, THE BIDDER IS HEREBY CERTIFYING THAT THEY ARE IN FULL COMPLIANCE WITH ACT NO. 2006-557**, THEY ARE NOT BARRED FROM BIDDING OR ENTERING INTO A CONTRACT PURSUANT TO 41-4-116, AND

ACKNOWLEDGES THAT THE AWARDING AUTHORITY MAY DECLARE THE
CONTRACT VOID IF THE CERTIFICATION IS FALSE.

Auburn University

Auburn University, Alabama 36849-5614

Office of the Director of Financial Services, Facilities
Facilities Management - Building 2

Telephone (334) 844-3821

Instructions Related to Construction Contracts -Tax Exemption

Auburn University as an instrumentality of the State of Alabama is a tax exempt institution. No sales and use taxes should be assessed for materials purchased by Auburn University, in accordance with Act 2013-205 which was signed into law on May 9, 2013. All material purchases (tangible personal property to be incorporated into realty) made in support of a University construction project will be paid directly by the contractor or sub-contractor to the material supplier net of taxes.

Act 2013-205 grants the Alabama Department of Revenue (ADOR) the authority to issue certificates of exemption from sales and use taxes for construction projects for certain governmental agencies. Certificates of exemption (Form STC-1) will be issued specific to each tax exempt project by applying to ADOR with Form ST:EXC-01. Both the governmental entity and the contractor shall apply for certificates of exemption. Certificates of exemption shall only be issued for contracts entered into (awarded) on or after January 1, 2014. Certificates shall only be issued to contractors licensed by the State Licensing Board for General Contractors or any subcontractor working under the same contract. Items eligible for exemption from sales and use tax are building materials, construction materials and supplies and other tangible personal property that become part of the structure per the written construction contract, with the exception of exemptions allowed by the law. ADOR will handle the administration of certificates of exemption and the accounting of exempt purchases. ADOR will have the ability to levy fines and may bar the issuance or use of certificates of exemption upon determination of willful misuse by the contractor or a subcontractor. The contractor shall account for the tax savings on the bid form.

All NEW vendors must register by going to: <http://vendor.auburnuniversity.net>. See attached memo (**Procurement & Payment Services**). Please call Procurement & Payment Services at 334-844-7771 for assistance.

A special **Contractor's Periodic Estimate for Payment** form (slight modification to current ABC form) is also attached for your use. An excel version of the spreadsheet is available; email your request to moselru@auburn.edu. Most of the information required on pages one and two are standard. Page 3 requires change order recap information.

DOCUMENTATION ATTACHED

1. Procurement & Payment Services Vendor Registration

Website for enrollment listed below.

If assistance is needed, please contact Procurement & Payment Services at (334) 844-7771.

<http://vendor.auburnuniversity.net>

2. Contractor's Periodic Estimate for Payment

Available in excel format or hardcopy (email moselru@auburn.edu if excel version required)

To be completed by contractor. Note detail sheet may be required.

Forms to be completed and mailed to:

Auburn University

Facilities Management, Financial Services, Building 2

1161 W. Samford Avenue

Auburn University, AL 36849

3. Act 2013-205

4. State of Alabama Building Commission summary letter for Act 2013-205

5. ADOR Proposed Changes to Administrative Rule 810-6-3-.77

Questions pertaining to Invoice procedures should be addressed to Bob Moseley at (334) 844-9423.

Sincerely,

Bob Moseley

Interim Director, Financial Services, Facilities Management, Auburn University

Auburn University

Procurement & Payment Services

Dear Vendor,

As a valued vendor/supplier to Auburn University, we wanted to make you aware of how to do business with AU. The **AU Vendor Center** is a web based system that provides both AU and our vendors with many enhanced features both now and in the future.

We require use of the AU vendor registration program to become a vendor. Registration as an AU vendor is easy through our **AU Vendor Center** website (<http://www.vendor.auburnuniversity.net>). There you will find registration instructions, service terms and conditions, and answers to frequently asked questions (FAQ's). The website was developed to allow for vendor registration, notification of bid and purchase order issuance, as well as monitoring of payments once direct deposit of your payments has been activated. The site has secure access that is controlled by a user ID and password that you create. Once you've completed the registration process, you'll be assigned a vendor ID number. Your number and information can then be accessed by using your user ID and password anytime, anywhere!

Register now by going to: <http://www.vendor.auburnuniversity.net> .

We are excited to be able to offer this enhanced service to our valued vendors! Because the ability to generate bids, purchase orders, and payments will be driven by this registration, it's imperative that we ensure you're registered.

Our vendor registration program is intended to be inclusive. If you are unable to register using the website due to lack of access to the web, please contact Vicky Smith in our office at (334) 844-7771.

Please remember that bids, purchase orders, parking permits, and payments cannot be issued to you until you have registered as a vendor via our AU Vendor Center! If you have any questions and/or need additional information after reviewing the registration website, please contact our office at (334) 844-7771. Guidelines to assist in the process are attached.

Thanks so much for doing business with Auburn University!

311 Ingram Hall Auburn University, AL 36849 (334) 844-7771

**Steps to Vendor Registration
Auburn University
Auburn, AL**

Only those vendors who have enrolled at the AU Vendor Center will be assured of being able to do business with Auburn University.

Steps to complete Vendor Registration Process:

- Step #1: Access the AU Vendor Center at the following link -- <http://www.auburnuniversity.net/vendor>
- Step #2: On the AU Vendor Center Web site, click on the hyperlink to New User Registration. There are hyperlinks located in the left-hand navigation or also located in the text under the “Welcome to the AU Vendor Center” section.
- Step #3: On the vendor registration page, complete the required information fields.
- Step #4: Click the “Register” button (located near the bottom right of the screen) after you have read the statements.
- Step #5: The screen should automatically return to the AU Vendor Center Web site. On the left side of screen you will see “Login as.” You will select “Vendor” for login.
- Step #6: Now log in as a vendor using the user ID and password you created in Step #3 above.
- Step #7: After you log in as a vendor, complete the following four (4) forms. Be certain to enter after each form.
- 1) Basic information
 - 2) W-9 form
 - 3) Payment verification (you have option of direct deposit or check by mail)
 - 4) Supplier (indicate the commodities your company can supply and if your business is Small/Minority owned)

If you need assistance with vendor registration, contact Vicky Smith at 334 844-7771.

CONTRACTOR'S PERIODIC ESTIMATE FOR PAYMENT
Incorporating Sales and Use Tax Agreement
AUBURN UNIVERSITY

Project: example: Haley Center Renovation

Location example: Haley Center

P.O. # example P401555

Contractor: example: John's Contractors

Address: ex - 1111 Smith Way, Opelika, AL
ex - 222 White Oak, Montgomery,

Architect: Example: Bill Doe

Address: AL

Pay Request Estimate No:

Date: 6/30/2004

2

Item No.	Description	Original Estimate	Percentage Complete	Amount Complete
1	General Requirements	\$638,116.00	39.00%	\$248,865.24
2	Sitework	\$577,102.00	16.00%	\$92,336.32
3	Concrete	\$1,647,482.00	3.00%	\$49,424.46
4	Masonry	\$395,891.00		
5	Metals	\$896,548.00		
6	Carpentry	\$142,017.00		
7	Roofing & Waterproofing	\$573,940.00		
8	Doors & Windows	\$112,713.00		
9	Finishes	\$638,342.00		
10	Specialities	\$56,010.00		
11	Equipment	\$142,758.00		
12	Furnishings	\$38,575.00		
13	Special Construction	\$158,292.00		
14	Conveying Systems	\$27,000.00		
15	Mechanical	\$2,244,950.00		
16	Electrical	\$681,575.00		
TOTAL ORIGINAL CONTRACT		\$8,971,311.00	4.35%	\$390,626.02

Note: Contractor shall attach a detailed breakdown of the above categories as required by Auburn University.

STORED MATERIAL LIST

Pay Request Estimate No:

2

Project Name:

*example: Haley Center
Renovation*

Project No.

04-278

Purchase Order No.

example P401555

Contractor's Name

example: John's Contractors

DESCRIPTION	Previous Invoices	Invoices this Month	Amount Used	Stored Material
General Requirements				
Sitework	\$670.40	\$1,255.00	\$670.40	\$1,255.00
Concrete	\$35,133.17	\$15,777.00	\$12,000.00	\$38,910.17
Masonry				
Metals				
Carpentry				
Roofing & Waterproofing				
Doors & Windows				
Finishes				
Specialities				
Equipment				
Furnishings				
Special Construction				
Conveying Systems				
Mechanical				
Electrical		\$4,089.82	\$2,044.00	\$2,045.82
Subtotal	35803.57	21121.82	14714.4	\$42,210.99
Total Stored Material				\$42,210.99

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

contract continued from page 2

Change Order Recap:

No.	Description	(+ or -)Value	% Complete	Value Complete
1	Add Restroom on 14th floor	\$125,000.00	10.00%	\$12,500.00
2	Caissons	\$11,500.00	20.00%	\$2,300.00
				\$0.00

NET AMOUNT OF CHANGE ORDERS:

\$136,500.00

REVISED CONTRACT AMOUNT:

\$9,107,811.00

- VALUE OF WORK IN PLACE:

\$405,426.02

- ADD STORED MATERIALS (FROM ATTACHED LIST)

\$42,210.99

SUBTOTAL FOR RETAINAGE CALCULATION:

\$447,637.01

LESS RETAINAGE (calculation based on subtotal above)

(\$22,381.85)

Refer to General Conditions, Article 29E and Supplemental General Conditions, AU Form C-8 SGC August 2001

TOTAL DUE TO CONTRACTOR

\$425,255.16

LESS PREVIOUS PAYMENTS TO CONTRACTOR

(\$192,825.00)

BALANCE DUE THIS ESTIMATE

\$232,430.16

Notary Seal Required:

I Certify that all amounts have been paid for Work for which previous Certificates for Payments were issued and payments received from the Owner, and, that the above account is correct, just, and that payment therefore has not yet been received.

Sworn to and subscribed before me this _____
day of _____, _____.

Contractor's Signature

Notary Public _____

Printed Contractor Name/Title

Checked and Approved by: _____
Architect's Signature

Dated: _____

Approved by AU Representative: _____

Dated: _____

ACT 2013 - 205

- 1 HB419
- 2 150466-6
- 3 By Representative DeMarco
- 4 RFD: Ways and Means Education
- 5 First Read: 07-MAR-13



1
2 ENROLLED, An Act,

3 Relating to construction projects of the State of
4 Alabama, counties, municipalities, local boards of education,
5 industrial development boards, and other governmental entities
6 which are exempt from the payment of sales and use taxes on
7 the purchase of building materials and construction materials
8 to be included in construction projects of the governmental
9 entity; to provide for the Department of Revenue to grant
10 certificates of exemption from sales and use taxes to
11 contractors and subcontractors licensed by the State Licensing
12 Board for General Contractors for the purchase of building
13 materials and construction materials to be used in the
14 construction of a building or other project for the
15 governmental entity, with the exception of any highway, road,
16 or bridge project; to provide for accounting for purchases and
17 enforcement for violation of the act; and to authorize the
18 Department of Revenue to adopt rules to implement the act.

19 BE IT ENACTED BY THE LEGISLATURE OF ALABAMA:

20 Section 1. (a) For the purposes of this act, the
21 ~~term "governmental entity" means any governmental entity or a~~
22 ~~political subdivision, department, or agency of a governmental~~
23 ~~entity or a board, commission, or authority of a governmental~~
24 ~~entity which is tax exempt from sales and use taxes by virtue~~
25 ~~of its governmental status, including, but not limited to, all~~

1 ~~of the following: The State of Alabama, a county, a~~
 2 ~~municipality, an industrial or economic development board or~~
 3 ~~authority, and an educational institution of any of the~~
 4 ~~foregoing including a public college or university, a county~~
 5 term "governmental entity" means the State of Alabama and its
 6 political subdivisions, including a county, a municipality,
 7 and an industrial or economic development board or authority.
 8 A governmental entity shall also include an educational
 9 institution of any of the foregoing Alabama political
 10 subdivisions including a public college or university, a
 11 county or city board of education, and the State Board of
 12 Education.

13 (b) (1) The Department of Revenue shall issue a
 14 certificate of exemption to the governmental entity for each
 15 tax exempt project.

16 ~~(b)~~ (2) The Department of Revenue shall grant a
 17 certificate of exemption from state and local sales and use
 18 taxes to any contractor licensed by the State Licensing Board
 19 for General Contractors, or any subcontractor working under
 20 the same contract, for the purchase of building materials,
 21 construction materials and supplies, and other tangible
 22 personal property that becomes part of the structure that is
 23 the subject of a written contract for the construction of a
 24 building or other project, not to include any contract for the
 25 construction of any highway, road, or bridge, for and on

1 behalf of a governmental entity which is exempt from the
2 payment of sales and use taxes.

3 (c) The use of a certificate of exemption for the
4 purchase of tangible personal property pursuant to this
5 section shall include only tangible personal property that
6 becomes part of the structure that is the subject of the
7 construction contract. Any contractor or subcontractor
8 purchasing any tangible personal property pursuant to a
9 certificate of exemption shall maintain an accurate cost
10 accounting of the purchase and use of the property in the
11 construction of the project.

12 (d) A contractor who has an exemption from sales and
13 use tax for the purchase of materials to use on a government
14 project shall file, in a manner as prescribed by the
15 department, ~~an annual report~~ reports of all exempt purchases.
16 The ~~annual report~~ reports shall be filed as a prerequisite to
17 renewal of a certificate of exemption.

18 (e) (1) The department may assess any contractor or
19 subcontractor with state and local sales or use taxes on any
20 item purchased with a certificate of exemption not properly
21 accounted for and reported as required.

22 (2) Any contractor or subcontractor who
23 intentionally uses a certificate of exemption in violation of
24 this act shall, in addition to the actual sales or use tax
25 liability due, be subject to a civil penalty levied by the

1 department in the amount of not less than a minimum of two
2 thousand dollars (\$2,000) or two times any state and local
3 sales or use tax due for the property and, based on the
4 contractor's or subcontractor's willful misuse of the
5 certificate of exemption, may be barred from the use of any
6 certificate of exemption on any project for up to two years.

7 (f) The department may adopt rules to implement this
8 act in order to effectuate the purposes of this act and to
9 provide for accurate accounting and enforcement of this act.

10 (g) In bidding the work on a tax exempt project, the
11 bid form shall provide for an accounting for the tax savings.

12 (h) The intent of this act is to lower the
13 administrative cost for the governmental entity, contractor,
14 and subcontractor for public works projects. It is not the
15 intent of this act to change the basis for determining
16 professional services from fair market value, which may
17 include sales and use taxes.

18 Section 2. This act shall be operative for contracts
19 entered into ~~October 1, 2013~~ January 1, 2014, or thereafter,
20 and shall not apply to any contract entered into prior to
21 January 1, 2014. In addition, this act shall not apply to any
22 contract change orders or contract extensions, including
23 revised, renegotiated, or altered contracts, when the original
24 contract was entered into prior to January 1, 2014. The

1 Department of Revenue may adopt rules to implement this act
2 after the effective date of this act.

3 Section 3. All laws or parts of laws which conflict
4 with this act are repealed.

5 Section 4. This act shall become effective October
6 1, 2013, following its passage and approval by the Governor,
7 or its otherwise becoming law.

1

2

3

4

Speaker of the House of Representatives

5

6

President and Presiding Officer of the Senate

7

House of Representatives

8

9

I hereby certify that the within Act originated in
and was passed by the House 09-APR-13, as amended.

10

11

12

13

Jeff Woodard
Clerk

14

15

Senate

07-MAY-13

Amended and Passed

16

House

09-MAY-13

Concurred in Sen-
ate Amendment

17

APPROVED

May 9, 2013

TIME

5 pm

Robert Bentley
GOVERNOR

Alabama Secretary Of State

Act Num....: 2013-203
Bill Num....: H-419

Recv'd 05/10/13 09:48amSLF

INSOR

npico
SPONSORS

HOUSE ACTION

I HEREBY CERTIFY THAT THE
RESOLUTION AS REQUIRED IN
SECTION C OF ACT NO. 81-889
WAS ADOPTED AND IS ATTACHED
TO THE BILL, H.B. 419

YEAS 84 NAYS 6

JEFF WOODARD, Clerk

I HEREBY CERTIFY THAT THE
NOTICE & PROOF IS ATTACHED
TO THE BILL, H.B. _____
AS REQUIRED IN THE GENERAL
ACTS OF ALABAMA, 1975 ACT NO.
919.

JEFF WOODARD, Clerk

CONFERENCE COMMITTEE

House Conferees _____

SENATE ACTION

DATE: 4-1-89 201

RD 1 RFD _____

This Bill was referred to the Standing
Committee of the Senate on
4-1-89

and was acted upon by such Committee in
session and is by order of the Committee
returned therefrom with a favorable report
w/amend(s) 1 w/sub 0 by a vote of

yeas 1 nays 1 abstain 0
this 24 day of APRIL 2013
[Signature] Chairperson

DATE: 4-1-89 201

RF 1 RD 2 CAL

DATE: _____ 201

RE-REFERRED RE-COMMITTED

Committee _____

I hereby certify that the Resolution as
required in Section C of Act No. 81-889
was adopted and is attached to the Bill.
HB 419

YEAS 51 NAYS 7

PATRICK HARRIS,
Secretary



STATE OF ALABAMA
BUILDING COMMISSION

770 WASHINGTON AVE
SUITE 444
Montgomery, Alabama 36130-1150
Telephone: (334) 242-4082
Fax: (334) 242-4182

ROBERT BENTLEY
Governor

Katherine Lynn
Director

October 28, 2013

TO: STATE AGENCIES, K-12 SUPERINTENDENTS, COMMUNITY COLLEGES, UNIVERSITIES

FROM: KATHERINE LYNN, DIRECTOR
ALABAMA BUILDING COMMISSION *Katherine Lynn*

SUBJECT: ACT 2013-205, CERTIFICATE OF EXEMPTION FROM SALES AND USE TAX FOR GOVERNMENTAL ENTITIES

Act 2013-205 was signed into law on May 9, 2013, granting the Alabama Department of Revenue (ADOR) the authority to issue certificates of exemption from sales and use taxes for construction projects for certain governmental agencies.

Summary

The full text of Act 2013-205 is available on the Building Commission's website at www.bc.alabama.gov. A brief summary of the Act is provided below:

- ADOR shall issue certificates of exemption from sales and use tax to governmental entities for each tax exempt project. Both the governmental entity and the contractor shall apply for certificates of exemption.
- Certificates of exemption shall only be issued for contracts entered into (awarded) on or after Jan. 1, 2014.
- Certificates shall only be issued to contractors licensed by the State Licensing Board for General Contractors or any subcontractor working under the same contract.
- Items eligible for exemption from sales and use tax are building materials, construction materials and supplies and other tangible personal property that become part of the structure per the written construction contract.
- ADOR will handle the administration of certificates of exemption and the accounting of exempt purchases. ADOR will have the ability to levy fines and may bar the issuance or use of certificates of exemption upon determination of willful misuse by the contractor or a subcontractor.
- The contractor shall account for the tax savings on the bid form.

Bidding of Projects Before Jan. 1, 2014

Projects bid before Jan 1, 2014 but awarded on or after Jan. 1, 2014 are still eligible for sales tax exemption regardless of whether the project was bid with or without sales tax. For projects bid before Jan. 1, 2014, the bid documents must specify if the contractor's bid shall or shall not include sales tax.

For projects bid before Jan. 1, 2014, if the project is bid with sales tax and the contractor and subcontractors purchase the materials tax exempt, prior to project closeout the contractor shall submit to the governmental entity a copy of the report filed with the Alabama Department of Revenue showing all exempt purchases. The actual sales tax savings indicated on the report shall be deducted from the final contract amount.

For projects bid after Jan. 1, 2014, the bid shall not include sales tax but the sales tax for the base bid and all bid items must be included on the contractor's bid proposal form. ABC Form C-3A indicates how the sales tax shall be accounted for on the bid proposal form and shall be modified by the project architect or engineer as appropriate for the bid items for each project. Failure of the contractor to complete the attachment to the bid proposal form indicating the sales tax as required by Act 2013-205, Section 1 (g) shall render the bid non-responsive.

Proposed Changes to Administrative Rules

Pursuant to Act 2013-205, the ADOR has proposed changes to the following administrative rules:

Rule 810-6-1-.46	Contractor's Liability
Rule 810-6-1-.46.01	Bleacher Systems, Lockers, Backstops, and Other Fixtures Installed in Gymnasiums
Rule 810-6-3-.77	Exemption for Certain Purchases by Contractors and Subcontractors in Conjunction with Construction Contracts with Certain Governmental Entities

A link to the proposed rules and information about the public hearings can be found on ADOR's website at <http://www.revenue.alabama.gov/analysis/upcoming-rule-hearings.cfm> . All interested parties may present their views in writing to the Secretary of the Alabama Department of Revenue, Room 4131, Gordon Persons Building, 50 N Ripley Street, Montgomery, Alabama 36132 at any time during the thirty-five (35) day period following publication of the notice or by appearing at the hearing.

If you have any questions, please feel free to contact Katherine Lynn at the Alabama Building Commission at (334) 242-4082 or the Alabama Department of Revenue at (334) 242-1170.

cc: Ms. Julie Magee, Commissioner, Alabama Department of Revenue
Mr. Ben Albritton, Assistant Attorney General

810-6-3-.77 Exemption for Certain Purchases by Contractors and Subcontractors in Conjunction with Construction Contracts with Certain Governmental Entities, ~~Public Corporations, and Educational Institutions.~~

(1) On and after ~~October 1, 2000~~ January 1, 2014, the sale to, or the storage, use, or consumption by, any contractor or subcontractor of any tangible personal property to be incorporated into realty pursuant to a contract awarded ~~prior to July 1, 2004~~ on or after January 1, 2014, with ~~any of the following a governmental entities, public corporations, and educational institutions~~ is exempt from all state, county, and municipal sales and use taxes. For the purpose of this rule, a governmental entity is defined as:

(a) ~~The United States government.~~ (b) The State of Alabama.

(c) (b) A county or incorporated municipality of the State of Alabama.

~~(d) A corporation created for public purposes pursuant to a provision of the Constitution of Alabama of 1901, or a general or local law of the State of Alabama.~~

(e) (c) An educational institution of ~~the United States government~~, the State of Alabama, or a county or incorporated municipality of the State of Alabama.

(d) An industrial development board created pursuant to Article 4 of Chapter 54 of Title 11, Code of Alabama 1975, as amended.

(2) The exemption outlined in paragraph (1) shall not apply to any of the following:

(a) Purchases of tangible personal property by a contractor or subcontractor for storage, use, or consumption in conjunction with performing a contract with a governmental entity, ~~public corporation, or educational institution~~ that is not itself exempt from state sales and use taxes.

(b) Purchases of tangible personal property by a contractor or subcontractor ~~of tangible personal property~~ that is are not incorporated into realty pursuant to the contract.

(c) Purchases of tangible personal property for contracts with the federal government.

(d) Purchases of tangible personal property made for any contracts for the construction of any highway, road or bridge for, or on behalf of, any governmental entity as outlined above.

(e) Purchases of tangible personal property made pursuant to any contract awarded, ~~revised, renegotiated, or otherwise altered on or after July 1, 2004~~ prior

to January 1, 2014. Items purchased after June 30, 2004, pursuant to a contract awarded prior to July 1, 2004, will continue to be exempt for the remainder of the contract, to the extent that any post June 30, 2004, revision or amendment does not require the purchase of additional tangible personal property. (Section 40-9-33, Code of Alabama 1975)

(3) The exemption outlined in paragraph (1) shall not apply to the sale to, or the storage, use, or consumption by, any contractor or subcontractor of any tangible personal property to be incorporated into realty pursuant to a contract with a state other than the State of Alabama, a county or incorporated municipality of a state other than the State of Alabama, an public corporation industrial development board created pursuant to the Constitution or general or local laws of a state other than the State of Alabama, an educational institution of a state other than the State of Alabama, or an educational institution of a county or incorporated municipality of a state other than the State of Alabama.

(4) In order to qualify for the sales and use tax exemption referenced in paragraph (1), the governmental entity shall complete an application (Form ST: EXC-01) for a sales and use tax certificate of exemption (Form STC-1) for each tax-exempt project. ~~Contractors and subcontractors who do not qualify as a "dual business" pursuant to Sales and Use Tax Rule 810-6-1-56 licensed by the State Licensing Board for General Contractors,~~ shall also apply per project to the Department of Revenue for a sales and use tax certificate of exemption (Form ~~STEC~~-1). ~~(See Sales and Use Tax Rule 810-6-5-02)~~ Upon review and approval of the application, the department shall issue the applicant a Form ~~STEC~~-1 which shall be used by the certificate holder to claim the exemption when making qualifying tax-exempt purchases for the project listed on the certificate. Before approving or denying the application, the Department of Revenue may require the applicant to submit additional documentation that the property to be purchased tax-exempt with the certificate will be incorporated into realty pursuant to contracts with one ~~or more~~ of the governmental entities, ~~public corporations, or educational institutions~~ enumerated in paragraph (1) or to subcontracts arising from contracts with one ~~or more~~ of the governmental entities, ~~public corporations, or educational institutions~~ enumerated in paragraph (1). If the department denies the application, the applicant may appeal the denial in accordance with Section 40-2A-8, Code of Alabama 1975. ~~A contractor or subcontractor who obtains a Form STE-1 shall comply with all of the provisions of Rule 810-6-5-02 and shall maintain records sufficient to document the tax-exempt status of qualifying purchases. (Section 40-9-33, Code of Alabama 1975).~~

(5) A contractor or subcontractor who obtains a Form STC-1 shall comply with all of the provisions of the Code of Alabama 1975, as amended, Section 40-23-9 and shall maintain records sufficient to document the tax-exempt status of qualifying purchases. Further, the contractor or subcontractor who presents Form STC-1 to a vendor for purchases of tangible personal property without the payment of sales or use tax must make a report of all exempt purchases to the Department of Revenue in a manner prescribed by the

department. The report of exempt purchases shall be a prerequisite to the renewal of a certificate of exemption. Failure to report the exempt purchases will result in an assessment against the contractor or subcontractor for sales and use taxes on any items purchased with the certificate of exemption.

~~(5) Contractors and subcontractors that qualify as a "dual business" and have obtained a sales tax license from the Department of Revenue are not required to obtain a Sales and Use Tax Certificate of Exemption (Form STE-1). In lieu of utilizing the Form STE-1 and following the procedures outlined in Sales and Use Tax Rule 810-6-5-.02, dual business contractors and subcontractors shall provide their sales tax account number to their vendors when purchasing tangible personal property which qualifies for the exemption outlined in paragraph (4), purchase the property without payment of sales or use tax to the vendor, and report the cost of the property withdrawn as a nontaxable withdrawal on their sales tax returns. Dual business contractors and subcontractors shall comply with all of the provisions of Sales and Use Tax Rule 810-6-1-.56 and shall maintain records sufficient to document the tax-exempt status of qualifying withdrawals.~~

(6) Any contractor or subcontractor who intentionally uses a certificate of exemption (STC-1) in violation of Act 2013-205 shall be (a) liable for the actual sales and use tax due, (b) subject to a civil penalty levied by the department in the amount of not less than a minimum of two thousand dollars (\$2,000) or two times any state and local sales or use tax due for the tangible personal property, whichever is the greater; and (c) may be barred from the use of any certificate of exemption (STC-1) on any project for up to two years based on the contractor's or subcontractor's willful misuse of a certificate of exemption.

~~(6)(7) The date of the sale to, or the purchase, withdrawal, storage, use or consumption by, the contractor shall be used to determine if an otherwise qualifying transaction or event qualifies for the exemption. With respect to jobs or projects commenced prior to, but not completed on, October 1, 2000 by January 1, 2014; otherwise qualifying transactions or events that occur prior to October 1, 2000 on or after January 1, 2014, shall not qualify for the exemption regardless of the transaction date. ; otherwise qualifying transactions or events that occur on or after October 1, 2000, shall qualify for the exemption. For purchases or withdrawals made after July 1, 2004, see Rule 810-6-3-.69.02.~~

(8) The amendatory language in this rule shall become operative on January 1, 2014.

Author: Traci Floyd, Ginger L. Buchanan

Authority: Sections 40-2A-7(a)(5), 40-2A-8, 40-23-31, 40-23-83, ~~and 40-9-33~~, Code of Alabama 1975, and Act 2013-205

History: New rule: Filed February 20, 2001, effective March 27, 2001.

Amended: Filed May 6, 2005, effective June 10, 2005.

PROPOSAL FORM

To: Auburn University 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:
New PEMB Building and associated sitework.

in accordance with Drawings and Specifications, dated January 30, 2015, prepared by
Kahn South, 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:

Project 13-194 AU Facilities Building #8:

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:

Project 13-194 AU Facilities Building #8:

For Alternate No. 1 Dock Canopy/ Fire Protection System (add) (deduct) \$ _____

For Alternate No. 2 Interior Liner panels in Warehouse 115 (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

Auburn University
BID OPENING
Public Works Contract over \$50,000.00

1. Bids are closed for...
AU Project:
AU Project#:
2. _____ Addenda has/ve been issued.
3. Required submittal/s for this bid is/are _____.
4. For purposes of establishing the low bidder by use of Alternates, in accordance with Paragraph 15 of the Instructions to bidders, the announced budget for this project is \$_____
5. Following the bid opening, bids will be available for public review in this room. A period of up to five (5) minutes will be allowed for the review of each bid. Bids must remain in public view before the bid official(s) while being reviewed.
6. In determining the lowest responsive bidder per statutory requirements and Alabama Building Commission rules...
 - a. A bid **MUST** be rejected if:
 - i. It does not bear the full, legal description of the bidder as required on pages 1 and 2 of the Proposal Form.
 - ii. It is not submitted with the required bid security.
 - iii. It does not bear an authorized signature of the bidder.
 - iv. It is for more than the amount requiring licensing pursuant to Title 34, Chapter 8, Code of Alabama, 1975 and does not bear the information regarding the bidder's state license for general contracting as required on page 2 of the Proposal Form.
 - v. Alabama Contractors license number must appear on the outside of the sealed envelope.
 - b. A bid **MAY** be rejected if:
 - i. It contains any omissions, alterations of forms, additions not called for, conditional bids, alternate bids not called for, incomplete bids, erasures, or irregularities of any kind.
 - ii. All, or part(s), of the planned work is bid on a unit price basis and any of the unit prices are obviously unbalanced or noncompetitive. This does not apply to unit prices requested for application to change orders, which may be rejected without rejecting the entire bid.
 - c. Also, in accordance with statutory requirements and Alabama Building Commission rules, bidders may be disqualified from consideration for contract award for the following reasons:
 - i. Collusion
 - ii. Advance Disclosure
 - iii. Failure to settle other contracts.
7. Auburn University reserves the right to waive technical errors and omissions and the right to reject any or all bids.

*** Please turn off cell phones***

ADVERTISEMENT FOR BID

Sealed proposals will be received from pre-qualified bidders by **Mr. Burl Sumlin, Jr.** on behalf of Dr. G. Jay Gogue, President of Auburn University at 1161 West Samford Avenue, Auburn University, AL 36849 until 3:00 PM Central Time, **Februaery 17, 2015** for:

13-194 Facilities Building 8 AUBURN UNIVERSITY

at which time and place they will be publicly opened and read in **Facilities Management Building One, Training Room A.**

A. SCOPE OF WORK:

The general scope of the work includes but is not limited to: Provide a new single-story Pre-manufactured metal building (approx.. 5,000 s.f.) on existing “Pad-ready” site with utilities in close proximity to building perimeter. Half the building is heated/vented Warehouse/Storage and the other half is conditioned Office fitout. IBC Construction Type IIB, fully sprinklered with fire alarm system with new electrical, mechanical and plumbing systems.

Prime contractors on this project must be prequalified.

For prequalification or additional info, please contact: **Joshua R. Conradson:** conrajr@auburn.edu; 334-740-8218

B. DOCUMENTS:

Drawings may be examined at the following locations:

Drawings and specifications may be examined at the Office of the Owner: Facilities Design and Construction Services, Facilities Management, Auburn University, AL.

Auburn University Website:

<https://sites.auburn.edu/admin/facilities/bidcalendar/Lists/Calendar/calendar.aspx>

BONDS:

A certified check or bid bond payable to Auburn University in an amount not less than five percent (5%) of the amount of the bid, but in no event more than \$10,000.00, must accompany the bidder’s proposal. Performance and Statutory Labor and Material Payment Bonds will be required at the signing of the Contract.

BIDS:

Bids must be submitted on proposal forms or copies thereof furnished by the Architect.

Dr. G. Jay Gogue, President
Auburn University
Auburn University, AL 36849

END

Dates of Advertisement:

Auburn Villager:

SPECIAL INSTRUCTIONS TO BIDDERS

a. FOR ALL AUBURN UNIVERSITY PROJECTS:

1. Contractor Certification per Federal Acquisition Regulation (FAR 48 C.F.R Ch. 1 Subpart 9.4)
 - a. Contractor certifies that neither it, nor any of its employees who will provide or perform services under this contract, have been debarred, suspended, or declared ineligible as defined in the Federal Acquisition Regulation (FAR 48 C.F.R. Ch. 1 Subpart 9.4). Contractor will immediately notify the University if the Contractor or any of its employees who will provide or perform services under this contract is placed on the Consolidated List of Debarred, Suspended, and Ineligible Contractors
2. Contractor Compliance with Section Nine of Act 2001-535
 - a. Section Nine of Act 2011-535, the new Alabama Immigration Law, requires that a Certification of Compliance Form and corresponding copy of the vendor one page E-Verify Company Profile Document (or MOU) be on file for vendors to whom contracts are awarded by the Auburn University system (including all AU, AUM, ACES, and AEES units). Before a contract can be awarded or a purchase order issued for these goods/services, the vendor will be required to complete the certification process on-line via the AU Vendor Center (www.vendor.auburnuniversity.net).

For more information about the E-Verify process, check one of the following websites:

<http://www.uscic.gov/e-verify>

<http://www.immigration.alabama.gov>

3. Contractor Compliance with Act 2012-491
 - a. Act 2012-491, Amended Alabama Immigration Law, requires that a Certification of Compliance Form and corresponding copy of the vendor one page E-Verify Company Profile Document (or MOU) be on file for vendors to whom contracts are awarded by the Auburn University system (including all AU, AUM, ACES, and AEES units).
4. Post Bid Communication
 - a. Auburn University intends to use email as its primary method for post bid communication and document transmittals related to this project. Any firm or individual wishing to submit a proposal for work included in

these documents will be required to maintain a valid email account. Instructions on what is required to be done with the documents will be included with the email when the document being transmitted is not self-explanatory. This will include Contracts, Change Orders, Contract Change Directives (CCD), Notice to Proceed, Letter of Intent, Notification of Apparent Low Bidder, Request for Proposal (RFP), Request for Information (RFI) and similar documents. These will be sent to the primary contact listed on the proposal form and copied to the secondary contact, if provided.

ATTACHMENT A TO PROPOSAL FORM

List of Subcontractors and Major Suppliers

1. HVAC:
Subcontractor Name/Phone: _____
2. Plumbing:
Subcontractor Name/Phone: _____
3. Fire Protection:
Subcontractor Name/Phone: _____
4. Electrical:
Subcontractor Name/Phone: _____
5. Sitework:
Subcontractor Name/Phone: _____
6. Metal Building Fabricator and Installer:
Subcontractor Name/Phone: _____

Note: Failure to complete and submit this attachment with proposal may be grounds for rejection of bid. Bidders must name one and only one entity for each of the above trades. Where the subcontractor and supplier or manufacturers are required, list both in the spaces provided. (Refer to Supplemental Instructions to Bidders for additional requirements.)

ATTACHMENT 'B' TO PROPOSAL FORM

STATED ALLOWANCES AND UNIT PRICES

STATED ALLOWANCE AND UNIT PRICES

The following items of work are anticipated during construction of this contract; however the exact quantity of each work item may not be determinable prior to bidding. The Contractor, shall therefore, include in his Lump Sum Base for Project 13-194 and / or Alternates Bid (as applicable), an allowance for the following items in the quantities indicated: Allowance Unit Prices include all charges for labor, materials and equipment, shoring, layout, supervision (field and home office), general expenses, taxes, insurances, overhead and profit, but not limited to, for accomplishment of the Allowance item(s). Where quantities of same items of work are defined and are quantified in the bid documents, the allowance quantities indicated hereinafter shall be in addition to those which are indicated. (Example: If the site grading plan indicates new and existing grades, the bidder shall compute the quantity of earthwork required and include that quantity of work in the bid the same as if no "allowance quantity were specified. If an additional allowance quantity of earthwork is stipulated, that stipulated allowance quantity of work shall also be included in addition to the quantity computed from the bidders earthwork "takeoff").

The following Unit Prices Quoted are for increases or decreases in the above quantities included in the Lump Sum Base and/or Alternate Bids. These Unit Prices include all charges for labor, materials and equipment, fee, layout, supervision (field and home office), general expenses, taxes, insurances, overhead and profit, but not limited to, for accomplishment of the Unit Price item(s).

Clarification Note: The Unit Prices quoted by the Contractor shall apply to increases (additive change orders) and to decreases (deductive change orders). This requirement shall supplement the requirements of the General Conditions, and Instructions to Bidders. Changes in the contract amount which are computed using the Stated Allowances and Unit Prices shall be figured at the same unit price whether additive or deductive.

<u>ITEM</u>	<u>ALLOWANCE QUANTITY</u>	<u>ALLOWANCE UNIT PRICE</u>	<u>TOTAL</u>
Excavation and haul-off of sub-grade material	<u>1</u> cubic yards		
Haul-in, placement and compaction of sub-grade material	<u>1</u> cubic yards		
Placement of reinforced concrete footing: Prep Base, Form, and Placement	<u>1</u> cubic yards		
Place silt fencing including all trenching, staking, and fencing	~~400~~ <u>1</u> linear feet		
Placement of 4" concrete pavement: Prep Base, Form, and Placement	36 square feet		
Provide and install new concrete curb stop	<u>1</u> curbs		
Provide and install bollard to match design reflected on Sheet A1.0 for a concrete paving condition	<u>1</u> bollards		
Provide and install a roof anchor post, Miller Fusion #X10002, as indicated on Sheet A1.2	<u>1</u> roof anchor posts		

ATTACHMENT C TO PROPOSAL FORM

Accounting of Sales Tax

To: Auburn University Date: _____

AU Project Number: _13-194

AU Project Name: ___AU Facilities Building 8

SALES TAX ACCOUNTING

Pursuant to Act 2013-205, Section 1(g) the Contractor accounts for the sales tax **NOT** included in the bid proposal form as follows:

ESTIMATED SALES TAX AMOUNT

BASE BID: \$ _____

Alternate No. 1 (Interior liner panels) (add)(deduct) \$ _____

Failure to provide an accounting of sales tax shall render the bid non-responsive. Other than determining responsiveness, sales tax accounting shall not affect the bid pricing nor be considered in the determination of the lowest responsible and responsive bidder.

Legal Name of Bidder _____

Mailing Address _____

* By (Legal Signature) _____

* Name (type or print) _____ (Seal)

* Title _____

Telephone Number _____

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

BC Project No. _____

CONSTRUCTION CONTRACT

- (1) _____
- (2) This Construction Contract is entered into this _____.
(3) between the **OWNER(s)**,
Auburn University
c/o Facilities Management
West Samford Avenue
Auburn University, AL 36849-5514
Phone: 334/844-9266
- (4) and the **CONTRACTOR**,

Phone: _____
- (5) for the **WORK** of the Project, identified as:
AU Project Name: _____
AU Project No.: _____
- (6) The **CONTRACT DOCUMENTS** are dated _____ and have been amended by _____
- (7) **ADDENDA**
One: _____
Two: _____
Three: _____
- (8) The **ARCHITECT** is _____

Phone: _____
- (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:**
Base Bid: _____
Alternate One: _____
Alternate Two: _____
Total: _____
- (11) The **CONTRACT TIME** is _____ (____) calendar days from the date of Notice to Proceed.

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 _____ (\$_____) per calendar day.

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

Special attention is called to Article 1 Item E of the General Conditions of the Contract. In addition to the items defined as part of the Contract Documents in Article 1 Item E of the General Conditions of the Contract, the following items shall be approved as part of this Contract:

Proposal Form
Attachment A to the Proposal Form – List of Subcontractors and Major Suppliers
Attachment B to the Proposal Form – Stated Allowances and Unit Prices
Form C-5A – Disclosure Statement
Form C-5C – Statement of Compliance with Act No. 2012-491

- (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
_____ By _____	_____ Contractor By _____
STATE OF ALABAMA BUILDING COMMISSION <i>(Not required for locally-funded, SDE projects.)</i>	Name & Title: _____
By _____ Director, Technical Staff	<u>Auburn University</u> Owner
	By _____ Name & Title <u>Dr. G. Jay Gogue, President</u>



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

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.

B.C. # _____

STATEMENT OF COMPLIANCE
with
Act No. 2012-491

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.

By _____
Signature of Officer of the Company

Date

Name and Title

Company Name

**Auburn University Safety Specification
Construction Contracts with No Construction Manager**

ATTACHMENT C: HEALTH AND SAFETY

1. GENERAL

- a. Safety is a critical requirement of this contract. As such, the safe performance of work by the Prime Contractor and its subcontractors is a contract requirement. Failure by the Prime Contractor or its subcontractors to work safely shall be viewed by Auburn University and its Project Manager as a failure to execute contract requirements.
- b. As a specialist in its field of work, the Prime Contractor accepts complete responsibility for performing its work safely. This includes sole responsibility for the health and safety of its employees, agents, subcontractors (and their employees) and any other person on or adjacent to the area. Prime Contractor's responsibility includes compliance with all current laws, codes, ordinances, rules, regulations, standards and requirements of applicable public and private agencies and authorities ("Laws"). Prime Contractor must take all measures and safeguards necessary to protect: (1) employees, (whether or not working for the Prime Contractor), (2) employees and agents of Auburn University, the Construction Manager and other Contractors, (3) members of the general public and (4) public and private property.
- c. Auburn University and the Prime Contractor recognize that the Prime Contractor is an independent contractor, with responsibility for its means and methods and the safety of its workers and that Auburn University are not intended to be and shall not be considered an employer of Prime Contractor's employees. As such, it shall be Prime Contractor's duty to monitor the performance and practices of its employees and subcontractors for safety, to insure that the practices and methods of performing the work are safe and to immediately stop any unsafe practices by its employees or its second or subsequent tier subcontractors ("subcontractors") or their employees. No actions taken by Auburn University to monitor practices or performance of the work for safety or to stop any unsafe practices by Prime Contractor or its subcontractors shall be construed to suggest or imply that Auburn University has or has assumed any obligation or duty to take such actions.
- d. Prime Contractor accepts complete responsibility for compliance with safety procedures and policies issued by Auburn University and/or contained in the Contract Documents and compliance with all applicable Laws, relating to health or safety, including, but not limited to the Occupational Safety and Health Act of 1970, as amended, and the regulations and standards of the Occupational Safety & Health Administration and similar state agencies ("OSHA") ("Health and Safety Laws"). Prime Contractor shall cooperate and coordinate with Auburn University, and all other Contractors and subcontractors in their respective safety programs. In exchange for one hundred dollars (\$100.00) and other good and valuable consideration, the amount of which is included in the Price, Prime Contractor agrees to defend, indemnify and hold harmless Auburn University and its officers, directors, agents and employees from and against any loss, liability, expense (including attorneys' fees), citations, assessments, fines or penalties resulting from any citation for, allegation of or violation of any Health or Safety Laws attributable in whole or part to the acts or omissions of Prime Contractor, its subcontractors "or their agents or employees. Prime Contractor's obligations hereunder shall not be limited as to amount or type of damages by the provisions of any worker's compensation act, disability act or other employee benefit act or by any insurance policy.
- e. All obligations and requirements of "Prime Contractor" in this document also apply to Prime Contractor's subcontractors. No person or entity performing work for or on behalf of Prime Contractor is excluded from compliance.

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- f. Prime Contractor shall comply with the safety-related recommendations of Auburn University and insurance companies having an interest in the Project unless such recommendations would violate applicable Laws. Prime Contractor shall provide written responses to any Auburn University or insurance company safety inspection outlining corrective actions and action plans to prevent recurrence.

2. THE ROLE OF THE AUBURN UNIVERSITY PROJECT MANAGER REGARDING SAFETY:

- a. The Auburn University Project Manager (hereafter referred to as "AU Project Manager (AU PM)" shall serve as Auburn University's agent on this project to ensure that all contract requirements relative to safety and the safe performance of work are being met. The AU Project Manager shall monitor the work performed to determine whether the Prime Contractor's safety program is resulting in compliance with the contract requirements for safety. The AU Project Manager shall take actions as necessary with the Prime Contractor to ensure that work is being completed in compliance with the safety requirements of this contract.
- b. The AU Project Manager may conduct and/or ensure the following meetings are conducted to help ensure safe execution of the work:

- AU PM conduct - Pre-bid meeting(s) – safety is first agenda item.
- AU PM conduct - Pre-Construction meeting(s) – safety is first agenda item.
- AU PM conduct - Pre-installation meeting(s) – quality and safety on tasks is the focus.
- Prime Contractor conduct - Project Safety Meetings with subcontractor project managers and superintendents.
- Prime Contractor conduct - Prime Contractor toolbox safety meetings.

The Prime Contractor shall conduct Project Safety Meetings safety meetings with its subcontractor project managers and superintendents on a regular basis to ensure coordination of safety efforts and to ensure the safe execution of work.

3. AREAS WHERE AUBURN UNIVERSITY'S SAFETY REQUIREMENTS EXCEED OSHA'S

- a. As stated in paragraph 1 above, OSHA safety requirements are the standard to which the Prime Contractor and its subcontractors must adhere.
- b. However, in the following areas, the safety requirements on this contract will exceed OSHA requirements:

1926.21 – Safety Training & Education (Confined Space):

Auburn University requires subcontractors engaged in confined space work follow procedures similar to general industry standards (1910.146) as no confined space standards have been established for construction.

1926.25 – Housekeeping:

Auburn University requires continuous housekeeping efforts.

– PPE

- Shirts with sleeves are required at all times
- Long pants are required at all times
- Substantial soled work shoes or boots are required at all times.
- Task Specific work gloves 100%

1926.50 – Medical Services & First Aid

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Regardless of reasonable accessibility to a medical care facility Auburn University requires each contractor to have a minimum of two (2) trained employees in first aid & CPR available at all times while the Contractor is working on site.

1926.100 – Head Protection

Auburn University requires hardhats be worn at all times in construction areas regardless of overhead exposures (exception – cab of covered equipment)

1926.102 – Eye Protection

Auburn University requires eye protection be worn at all times in construction areas regardless of exposure.

1926.404 – Wiring Design & Protection (Electrical)

Auburn University does not permit the use of an assured grounding program on site in lieu of use of GFCI (Ground Fault Circuit Interrupters).

1926.416 – General Requirements (Electrical)

Electrical tie-ins shall be conducted only on de-energized systems. If a condition makes this impossible, then a pre-task meeting with Auburn University is required. All energized work “live work” shall conform to NFPA 70E (Standard for Electrical Safety in the Workplace).

Auburn University does not permit electrical tape to be used to repair incidental damage to the outer jacket insulation of an extension cord. The cord must be repaired or replaced.

Subpart K – Electrical

Extension cords used with portable tools must be of a heavy duty 3-wire type and must be 12 gauge or greater.

1926.451(g) – General Requirements (Scaffolding)

Auburn University requires scaffolds have all open ends protected at 6 feet or greater.

1926.451(g)(2) – General Requirements (Scaffolding/Fall Protection)

Auburn University requires fall protection be used during scaffold erection and dismantling. The decision is not left with the competent person to determine feasibility of fall protection.

Subpart M – Fall Protection

100% Fall Protection is required above 6 feet. (Note: also see paragraph 16 of this specification section)

Note: Exceptions provided within the Occupational Safety and Health construction standards for the use of non-conventional fall protection measures (i.e., fall protection plans, controlled access zones, safety monitors) are not permitted by Auburn University. Therefore, where any employee is exposed to a fall (6) six feet or greater, where passive fall protection cannot or has not been installed (i.e., guardrails, safety nets, etc.), Subcontractor shall provide its employees with a fall restraint/fall arrest system that protects its employees 100% of the time. This requirement does not apply to ladder access and egress unless required by OSHA.

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1926.550 (a)(6) – Crane Inspection

Auburn University requires that the annual inspection be completed by a third party prior to the crane being used on the project. Auburn University does not accept an annual inspection by a Prime Contractor “competent” person or company employee as proof. (Note: also see paragraph 16 of this specification section)

1926.1053 – Ladders

Auburn University requires that job built ladders be built in accordance with ANSI a14.4. Portable metal ladders shall not be used on the construction project

- c. The Prime Contractor and its subcontractors shall conform to these more stringent safety requirements as part of the terms of this contract.

4. SITE SAFETY PLAN

- a. Proper planning is the key to safe performance. This planning will be accomplished through the submittal of a Site Safety Plan.
- b. The Site Specific Safety plan shall be considered an Additional Submittal as identified in Supplemental Instructions to Bidders (AU Form C-2 SIB), required within ten (10) days of AU notification of low apparent bidder. In order to prevent delay in contract execution, the awarded contractor must submit a project site specific safety plan in accordance with this document, to the Owner within ten (10) days of notification. For each day delay in delivery of an acceptable submittal, a day will deducted by change order from the contract duration. Regardless no work on site shall be performed until the site safety plan has been received. Delay in submitting a written Site Safety Plan will not constitute grounds for a contract schedule extension or delay claim related to Prime Contractor not being permitted to work. The Site Safety Plan must comply with applicable Laws and be updated as required as the project progresses.
- c. Appendix A of this Attachment provides the required format for the Prime Contractor's Site Safety Plan. All items and topics listed in Appendix A must be covered, as applicable, in the Prime Contractor's Site Safety Plan. The AU Project Manager may waive certain sections deemed to be not applicable to this project or site, but in general, the requirement will be to cover all items listed.
- d. Activity Hazard Analyses: A key component of the Site Safety Plan is Activity Hazard Analyses (AHA). Appendix B to this Attachment details the requirements for the Prime Contractor in submitting AHAs.
- e. The AU Project Manager's review of, or comment on, the Site Safety Plan or any other safety plan, policy or procedure, shall not relieve the Prime Contractor of any responsibility or liability for the Site Safety Plan or such other safety plans, policies, or procedures. Upon review of the Site Safety Plan, the AU Project Manager reserves the right to advise Prime Contractor of deficiencies and recommend necessary changes or enhancements; however, Prime Contractor shall remain ultimately responsible for implementing a Site Safety Plan compliant with applicable Laws and for completing the work in accordance with the Site Safety Plan.

5. OSHA 10 HOUR TRAINING

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- a. Prime Contractor is responsible for ensuring that Prime Contractor and all of its subcontractors have at least one (1) member of their full-time supervisory staff on-site during all operations who has been certified or is currently enrolled in a 10-Hour OSHA Safety Training course. Prime Contractor and all of its subcontractors whose contract volume exceeds five million dollars (\$5M) are required to have at least one additional OSHA 10-Hour certified person on site at all times. Prime Contractor and its subcontractor(s) shall provide the names of certified persons and a copy of their OSHA certification cards or enrollment certification to the AU Project Manager prior to project mobilization.

6. SAFETY SUPERVISORS AND COMPETENT PERSONS

- a. Prime Contractor shall appoint one or more individuals to be responsible for safety on each contract ("Safety Supervisors"). The Safety Supervisors must be employed in a supervisory position, empowered by Prime Contractor to take corrective action; be present on the Project while work is being performed; and spend the amount of time necessary to ensure Prime Contractor's compliance with safety requirements. Prime Contractor shall submit, in writing, the name or names of the Safety Supervisors prior to project mobilization.
- b. In addition to the Safety Supervisors, Prime Contractor must identify, for each operation, whether the Safety Supervisor(s) or another individual is the "competent person." The competent person must be an individual deemed and qualified as a competent person as required and defined by OSHA as: "one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them" or such other definition as OSHA regulations may contain.
- c. Prime Contractor acknowledges that the Prime Contractor's most senior level manager present on the Project while work is being performed is ultimately responsible for all safety management activities of said Prime Contractor and its subcontractors.
- d. Should Auburn University reasonably determine that any Safety Supervisor and/or competent persons or manager is not fulfilling his duties, The AU Project Manager may direct Prime Contractor to remove and replace said individual at Prime Contractor's sole expense without delay. The AU Project Manager's right to take such action shall not be construed as an obligation on the part of the Auburn University to do so or as an obligation by Auburn University to evaluate, monitor, or control Prime Contractor's Safety Supervisors, competent persons or managers.

7. COMMUNICATION WITH NON-ENGLISH SPEAKING WORKERS

- a. Prime Contractor shall provide a translator at all times when Prime Contractor or its subcontractors has non-English speaking workers on-site.
- b. This individual must be identified to the AU Project Manager prior to mobilization and shall be present during all work operations, specifically including, but not limited to, all employee meetings, when Prime Contractor (or its second or subsequent tier subcontractors) has non-English speaking workers on site.

8. PRESENCE OF INDIVIDUALS TRAINED IN FIRST AID/CPR

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- a. Prime Contractor is responsible for ensuring that Prime Contractor and all of its subcontractors have a minimum of two (2) full time persons trained in first aid and CPR ("First Aid Responder") who is on site at all times while Prime Contractor or its subcontractors are working
- b. Prime Contractor will maintain written certification of First Aid Responder's training and make documentation available to the AU Project Manager upon request.
- c. Prime Contractor shall have adequate first aid and emergency medical equipment on site as necessary.

9. PRIME CONTRACTOR SAFE-START MEETING

- a. Prior to mobilization, Prime Contractor and its subcontractors must conduct a Safe-Start Meeting. Prime Contractor maintains responsibility for scheduling and conducting this meeting with its subcontractors. The purpose of the Safe Start Meeting is to ensure that all Prime Contractor personnel and their subcontractors have been briefed on the Project safety Plan, project site hazards, and the safety policies, practices, and procedures to be utilized during the duration of the project. The Prime Contractor shall invite the AU Project Manager to the Safe Start meeting.
- b. No work on-site shall be performed until the Safe Start Meeting has been completed and Prime Contractor has submitted all documentation required by the AU Project Manager. Delay in scheduling this meeting and/or providing required documentation will not constitute grounds for a contract schedule extension or delay claim related to the Prime Contractor or its subcontractors not being permitted to work.

10. PROJECT SAFETY MEETINGS

The Prime Contractor shall lead project safety meetings between the Prime Contractor and all the subcontractors on the project. The purpose of these meetings shall be to review: (1) safety problems on the job site, (2) courses of action to take to eliminate those safety problems, (3) hazards associated with upcoming activities of the Prime Contractor and subcontractors and (4) the Prime Contractor's and subcontractor's plans to mitigate those hazards.

11. SAFETY TRAINING AND ORIENTATION

- a. Prime Contractor acknowledges its responsibility to provide its employees and the employees of its subcontractors with a Project specific orientation prior to performing work on the Project. Topics covered must be relevant to the tasks the employees will be required to complete on the Project in addition to any site-specific requirements. Prime Contractor shall maintain training documentation on-site and make it available for review by the AU Project Manager if requested.
- b. The AU Project Manager may require Prime Contractor's employees and the employees of its subcontractors to participate in an additional project orientation conducted by the AU Project Manager. This training will not replace the orientation training referenced in section (8.a) and Prime Contractor acknowledges that any project orientation conducted by the AU Project Manager is solely for the purpose of an introduction to the Project site. Prime Contractor shall be solely responsible for conducting Project site hazard assessments, for providing appropriately trained competent persons and Safety Supervisors and for orientation and training of all of its employees on the Project site.

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- c. Where applicable Laws require the performance of certain duties by individuals having specified training or certification, Prime Contractor agrees that such duties shall be performed only by individuals having the required training or certification at no additional cost to Auburn University even if new or additional training is necessary to meet such requirements. Prime Contractor shall be responsible for determining what, if any, additional training is required and prior to commencing work shall provide all training, including any specialty training required by OSHA and other public or private authorities, to its employees and employees of its subcontractors. Prime Contractor shall maintain documentation of such training and make it available for inspection by the AU Project Manager for the purpose of confirming the training. Prime Contractor shall be solely responsible for assessing the content of the training and ensuring that all required training is completed.
- d. Prime Contractor's supervisors and employees will be required to attend safety meetings when requested by the AU Project Manager. Prime Contractor must ensure its subcontractors' participation.
- e. Prime Contractor must attend, at no cost to the Auburn University, all safety and health meetings relating to Prime Contractor's work on the Project site.

12. ACCIDENT/INCIDENT REPORTING

- a. Any accident, incident, allegation or citation relating to Health and Safety Laws involving Prime Contractor or its subcontractors must be reported to the AU Project Manager immediately whether or not the incident results in employee injury, property damage, or damage or injury to any third party. A preliminary accident/incident report must be forwarded to the AU Project Manager before the end of the shift, and the completed report submitted within 24 hours unless the AU Project Manager grants Prime Contractor's written request for a time extension. In addition to the completed report, Prime Contractor shall also timely submit any additional documentation relating to the incident requested by the AU Project Manager or required by applicable Laws. Such documentation may include, but is not limited to, the following (a) a copy of "Employer's First Report of Injury" (in the event of an injury); (b) a copy of all property or casualty insurance claim reports; (c) a copy of any and all OSHA inspection or citation reports; and (d) a copy of any drug test obtained as the result of any incident.
- b. In the event of an accident or incident involving Prime Contractor or its subcontractors, Prime Contractor will cooperate fully with the AU Project Manager in addressing any and all issues relating to the accident or incident, including making its employees and other resources and materials available for any investigations, meetings, insurance inspections, attorney reviews or other actions deemed necessary by the AU Project Manager. Prime Contractor acknowledges time is of the essence in providing the support the AU Project Manager deems necessary in response to an incident/accident. Should Contractor determine third party support is necessary to aid in investigation or mitigation of damages, Prime Contractor will request, arrange and pay for such support services.
- c. Prime Contractor shall provide to the AU Project Manager, by the 5th day of each month, for each previous month in which it conducted or oversaw work on the Project, an Accident Statistical Report to include: all accidents that have occurred during the month, classification of such accidents, lost and/or restricted days, and total man-hours worked for the month. The report shall include cumulative totals and be broken-out for the Prime Contractor and its subcontractors.

13. DRUG TESTING

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- a. It is Auburn University policy that:
 - (1). All construction contractor personnel working at the University must be drug free.
 - (2). All prime contractors and their respective subcontractors will have an effective drug testing program.
- b. The Prime Contractor, and their respective subcontractors, must certify at the start of the project, that their employees have been drug tested within the last 12 months from the date of the their respective NTP date.
- c. The Prime Contractor and their respective subcontractors need to have a drug testing policy and program. All prime contractors shall advise Auburn University of what the company policy and program is for drug testing, how it is administered on a general basis and how it will be administered during the course of this contract. Documentation that the prime contractor has a Drug Free Workplace program certified by the State of Alabama will meet this requirement. Prime contractors must recertify with invoices that they are drug testing and tell how many test were performed during the invoice period.
- d. The Prime Contractor and their subcontractors shall be required to drug test employees after a safety incident. At a minimum, the person involved in the incident and others who may have contributed to the incident shall be tested.
- e. Auburn University reserves the right to request drug tests on any personnel who exhibit signs or behavior that they may be impaired or under the influence of drugs or who are operating in an unsafe manner. Auburn University reserves the right to conduct the following types of drug tests: random (groups of people), reasonable suspicion (individual), or project (all personnel) sweep testing.
- f. Any personnel who fail to pass a drug test shall be removed from this project, and any other Auburn University project, for the duration of this contract.

14. OSHA INSPECTIONS

- a. Prime Contractor shall contact the AU Project Manager immediately if an OSHA compliance officer arrives at the job site and shall inform the AU Project Manager of any employee complaint, incident, or other event that results in or is likely to result in an OSHA Inspection.
- b. Prime Contractor shall forward a copy of any and all OSHA inspection or citation reports to the AU Project Manager upon receipt.
- c. As part of indemnification set out in Article 18, should Auburn University receive an OSHA citation arising out of or relating to an act or omission of Prime Contractor or an act or omission for which Prime Contractor is also issued a citation, Prime Contractor will pay all costs associated with the defense of Auburn University during any proceedings with OSHA or related litigation or claims, including but not limited to attorney fees, expert witness fees, time associated with the Auburn University or its personnel in conjunction with this citation, costs, including but not limited to costs of photographs, and video tapes, and any fines. Additionally, if requested by the Auburn University, Prime Contractor will make available its employees, records and other resources the Auburn University deems necessary for its defense.

15. HAZARD COMMUNICATION

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Prime Contractor is required by OSHA regulations to institute a hazard communications program, as part of which it must inform both the AU Project Manager and all other trade subcontractors on the Project site of any hazardous chemicals Prime Contractor is using on the Project. Prime Contractor must also provide the AU Project Manager and all other trade subcontractors with copies of Material Safety Data Sheets (MSDS), warn of the existence of any hazardous chemicals in the work area, ensure that any containers of hazardous chemicals are appropriately labeled, and maintain an inventory of any such chemicals.

16. **PHYSICAL CONDITIONS** – Topics identified within this section are included to add emphasis to Auburn University's requirements and are not intended to be all inclusive. As previously referenced, this specification provides summary guidance regarding certain health and safety items and should be reviewed in conjunction with and not as a substitute for the Safety Policy and all applicable Laws relating to the operations Prime Contractor will perform.

a. **FALL PROTECTION**

- (1). Prime Contractor acknowledges and adopts the Auburn University zero tolerance policy for fall prevention and protection infractions and understands anyone found violating this policy may be removed from the site immediately.
- (2). Prime Contractor shall provide its employees with and enforce the use of 100% fall prevention/protection system whenever its employees are exposed to a fall (6) six feet or greater, including but not limited to any walking/working surface (horizontal and vertical) with an unprotected edge, leading edge work, roof work, steel erection, metal decking, pre-cast operations, overhand brick or block laying, or scaffold erection.
- (3). Prior to commencing work, Prime Contractor must provide the AU Project Manager with an OSHA compliant fall prevention and protection plan specific to the Prime Contractor's operations. Prime Contractor acknowledges and understands that the exceptions provided within the Occupational Safety and Health construction standards for the use of non-conventional fall protection measures (i.e., fall protection plans, controlled access zones, safety monitors) will not be permitted on this Project. Therefore, where any employee is exposed to a fall (6) six feet or greater, where passive fall protection cannot or has not been installed (i.e., guardrails, safety nets, etc.), Prime Contractor shall provide its employees with a fall restraint/fall arrest system that protects its employees 100% of the time. This requirement does not apply to ladder access and egress unless required by OSHA. Additionally, unless required by OSHA, this requirement does not apply when employees are making an inspection, investigation, or assessment of workplace conditions prior to the actual start of construction work or an inspection after completion of construction work.
- (4). If Prime Contractor is required to remove any fall prevention or protection equipment previously installed on the Project to facilitate access to its work (e.g., perimeter guardrails, hole covers, etc.), Prime Contractor must first coordinate such removal with the AU Project Manager. Additionally, Prime Contractor is responsible for establishing alternate provisions to protect and warn its employees and other trades and Contractors that could be exposed to falls six (6) feet or greater as a result of the fall prevention equipment being removed. Further, upon completion of its work, and if materials installed by Prime Contractor do not eliminate the falling hazards, Prime Contractor must reinstall all previously installed fall prevention and protection equipment. If Prime Contractor fails to reinstall said fall prevention and protection equipment, reinstallation of this equipment may be done by others at Prime Contractor's cost and expense. In all instances, Prime Contractor shall remain solely responsible for the safe removal and reinstallation of such equipment.

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- (5). Prime Contractor acknowledges that in addition to providing personal fall arrest equipment to its employees, Prime Contractor shall provide fall protection training in accordance with OSHA standards. Prime Contractor shall maintain training documentation on-site and make it available for review by the AU Project Manager if requested.
- (6). Prime Contractor's Safety Supervisor shall ensure appropriate set up and use of all fall prevention and protection components established to protect its employees and shall adhere to all OSHA and manufacturers' recommendations for proper set up and use.
- (7). Prime Contractor shall thoroughly inspect each of its fall prevention and protection systems at least daily focusing on items including, but not limited to, whether the system is in working condition, whether the correct system is selected, whether the system is appropriately designed and instructions for use are being followed, whether the system is appropriately anchored, whether fall distances have been taken into consideration and whether all employees have been trained.

b. PERSONAL PROTECTIVE EQUIPMENT

- (1). Prime Contractor shall be solely responsible for conducting a hazard assessment of the Project site in which it will be working, including an analysis of all of its work activities, for providing its employees with all safety items required by applicable Health and Safety Laws, for ensuring the appropriate personal protective equipment ("PPE") is being issued and used for the task at hand in accordance with applicable Laws (e.g., respiratory protection, ear plugs, fire retardant clothing, gloves, hard hats, safety glasses, and face shields). If specialty training is required for use of such equipment, Prime Contractor must ensure this training is provided to its employees.
- (2). All Prime Contractor personnel shall wear ANSI Z87.1 approved safety glasses with approved side shields. Persons with prescription glasses shall wear ANSI Z87.1 approved prescription safety glasses with permanently attached side shields, or ANSI Z87.1 approved goggles to cover their existing glasses 100% of the time while working on the Project site.
- (3). All Prime Contractor personnel shall wear non-metallic hard hats meeting ANSI Z89.1 specifications 100% of the time while working on the Project site. This requirement specifically includes all work completed during the finishing stages of the Project.
- (4). Prime Contractor personnel shall wear personal clothing and footwear that is safe for the work and any jobsite exposure. At a minimum, full-length trousers and shirts with a minimum 4-inch sleeve are required. Work boots are required for all personnel on site.

c. HOUSEKEEPING

- (1). The Prime Contractor shall take all necessary measures to keep the job site clean, to ensure debris is picked up and hauled off-site on a regular basis and in a timely manner, to store material in a manner that is safe and does not clutter the job site, and to police the job site or work area on a daily basis.
- (2). Auburn University reserves the right to direct the Prime Contractor and their subcontractors to take additional measures to clean the job site if their efforts are unsatisfactory.

d. CRANES, LIFTING, AND HOISTING EQUIPMENT

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- (1). Prior to any crane or other lifting or hoisting equipment ("Crane") being brought onto site by or for the use of Prime Contractor, Prime Contractor shall provide the AU Project Manager with a copy of a current third party annual crane inspection. A certification sticker alone is not acceptable proof of the annual inspection.
- (2). For any Crane requiring on-site assembly (e.g., lattice boom, tower, hydro with jib attached) Prime Contractor must provide the AU Project Manager with a post-set up inspection and certification letter certifying that the Crane has been assembled in accordance with manufacturer's specifications and a pre-use inspection has been conducted and the Crane meets all manufacturer's inspection criteria.
- (3). Cranes requiring no on-site assembly must be inspected prior to use and Prime Contractor must provide the AU Project Manager with a certification letter certifying that a pre-use inspection has been conducted and the crane meets manufacturer's inspection criteria.
- (4). All Cranes must be inspected daily and according to manufacturer's recommendations and the daily inspection log must be kept in the cab of the Crane and made available for review by the AU Project Manager.
- (5). All Cranes being brought onto site must be equipped with a functioning anti-two-blocking device.
- (6). Prime Contractor must determine if work is being performed in states or cities requiring licensing for Crane operators. If so, required copies of the operator's license must be submitted to the AU Project Manager prior to operation of the crane in addition to a letter attesting that upon review of the operator's experience and education the Crane operator is qualified and competent to operate the Crane or Cranes he/she will be required to operate on the Project. This letter must be submitted to the AU Project Manager prior to operation of the Crane.
- (7). In states or cities where Crane operator licensing is not required Prime Contractor must certify licensing is not required. Additionally, Prime Contractors must be able to provide proof of certification from the National Council for the Certification of Crane Operators or a letter or other written document from the Prime Contractor or subcontractors' Crane training organization attesting that the operator meets all required certifications and that upon review of the Crane operator's experience and education the Crane operator is qualified and competent to operate the Crane or Cranes he/she will be required to operate on the Project. This letter must be submitted to the AU Project Manager prior to the operation of the Crane.
- (8). Cranes may be operated only by individuals trained in their operation and possessing all required certifications as identified in Paragraph 13 vi & vii. Further, Prime Contractor must comply with said provisions outlined in Paragraph 16 vi & vii if Crane operators will be changed or replaced.
- (9). Cranes must be used specifically for their designed purpose as established by the equipment manufacturer. Any deviation must be authorized by the equipment manufacturer and said authorization letter must be provided to the AU Project Manager.

e. **OTHER EQUIPMENT**

- (1). All equipment brought on site by Prime Contractor must be inspected at intervals established either by OSHA or the equipment manufacturer, whichever is more often. Any deficiencies found during the inspection must be addressed immediately or the

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equipment shall be taken out of service and locked and tagged out (in accordance with OSHA standards) until such time as it is repaired. Should the AU Project Manager observe a piece of equipment in disrepair and notify Prime Contractor, upon notification Prime Contractor must either repair the equipment immediately or take it out of service and lock and tag it out until such time as the repair can be made.

- (2). Equipment must be used specifically for its designed purpose as established by the equipment manufacturer. Any deviation must be authorized by the equipment manufacturer and said authorization letter must be provided to the AU Project Manager.
- (3). Equipment may be operated only by individuals trained in its operation and possessing all required certifications.

17. INSPECTIONS

- a. Prime Contractor acknowledges that certain operations require its competent person to perform inspections and implement certain procedures prior to employees performing work. Prime Contractor shall insure that a competent person takes such actions (which may include, but is not limited to, scaffold inspection, excavation inspections, lock out tag out, confined space, hot work, and crane and equipment inspections). Prime Contractor acknowledges its responsibility to determine and ensure all policies regarding inspections and procedures are followed.
- b. Prime Contractor's Safety Supervisor(s) or other competent person(s) shall inspect the Project daily for unsafe behaviors and conditions and shall address any such issues immediately. Prime Contractor shall, at least weekly, conduct a formalized project inspection and provide documentation of such inspection to the AU Project Manager.

18. DISCIPLINARY ACTION/WORK STOPPAGE

- a. Prime Contractor shall enforce all disciplinary procedures the AU Project Manager may establish for the Project.
- b. In the event that Prime Contractor or any of its employees or those of its Prime Contractors fail to comply with any health and safety requirements, or if Auburn University deems any part of the Work unsafe, the Project Manager may require Prime Contractor to stop work and/or remove any non-complying employees or supervisors. Prime Contractor shall not be entitled to any additional time or money as a result of the Project Manager stopping the work when the work was stopped due to the Project Manager's concern about safety deficiencies. Prime Contractor shall review and comply with the safety and health provisions of this contract, including, but not limited to this specification and its associated appendices, the Contract Documents and the Safety Policy. Failure to comply shall be considered a breach of contract.
- c. Auburn University reserves the right to retain additional funds from Prime Contractor payments if their safety performance, or that of their subcontractors, is poor.

Appendix A to Attachment C

Project Site Safety Plans

Prior to commencing work on an Auburn University project; contractors must submit a Site Safety Plan to demonstrate the existence of a safety program and sufficient planning that will ensure that they can work safely at Auburn University. The prime contractor will write this plan for the specific work and hazards of this contract and the project site and implementing in detail the requirements for safety and occupational health. The Site Specific Safety Plan shall be considered an Additional Submittal as identified in Supplemental Instructions to Bidders, required within ten (10) days of project award. In order to prevent delay in contract execution, the awarded contractor must submit a project site specific safety plan in accordance with this document, to the Owner within ten (10) days of award. **The plan shall be developed by qualified personnel and shall be signed by a competent person AND a representative of the Prime Contractor's management.**

The Prime Contractor shall integrate all subcontractor work activities into the Site Safety Plan, make the program available to all contractor and subcontractor employees, and ensure all subcontractors integrate the provisions of the plan into their work activities.

The Site Safety Plan must include, at a minimum:

- a. Title, signature and phone number of the plan preparer
- b. Title, signature and phone number of the plan approver
- c. Background information on the project: Contractor, contract number, project name, description of work to be performed and location of work to be performed, contractor accident experience such as OSHA 200 forms, corporate safety trend analysis, and a listing of phases of work and hazardous activities requiring hazard analysis.
- d. Statement of safety & health policy
- e. Administrative responsibilities for implementing the plan
- f. Identification and accountability of personnel responsible for accident prevention
- g. Means for controlling work activities of subcontractors and suppliers
- h. Responsibilities of subcontractors
- i. Plans for safety indoctrination of new employees
- j. Plans for continued safety training
- k. Activity Hazard Analyses
- l. Local requirements for the hazards identified on the job site such as:
 - 1) Fall protection
 - 2) Asbestos exposure
 - 3) Confined space entry
 - 4) Lock out/tag out

Appendix A to Attachment C

Project Site Safety Plans

- 5) Excavations
 - 6) Electrical safety
 - 7) Machinery and mechanized equipment
 - 8) Hand and power tools
 - 9) Contingency plan for severe weather
- m. Provisions for safety inspections to include:
- 1) Work site/material and equipment inspection
 - 2) Means for recording inspection results
 - 3) Timetable for correction of deficiencies
 - 4) Procedures for follow-up inspections to ensure correction
- n. Responsibilities for investigation and reporting accidents/incidents/exposures:
- 1) All accidents/incidents to the project will be investigated & reported within 24 hours
 - 2) Accidents that result in a person being admitted to a hospital or significant property damage will be reported immediately to the Auburn University Project Manager. Contractors are responsible for notifying OSHA. The accident scene shall not be disturbed except for rescue and emergency measures until released by the investigating official.
 - 3) First aid treatments shall be reported and recorded daily.
- o. Responsibilities for maintaining accident data, reports and logs
- p. Emergency response capabilities for disasters
- q. Emergency Plans will include emergency phone numbers and shall be tested periodically. Plans shall include escape procedures, employee accounting following an emergency evacuation, rescue and medical duties, means of reporting emergencies and persons to be contacted.
- r. Plans for maintaining job cleanup and safe access
- s. Public safety requirements (fencing/signs)
- t. Prevention of alcohol/drug abuse on the job
- u. Plans must identify monthly supervisor safety meeting and weekly worker safety meetings. Meetings shall be documented including the date, attendance, subjects, and the name of individuals who conducted the meeting.
- v. Fire Safety requirements must identify the use of safety cans in construction areas. Storage of fuel and flammable materials must be addressed in the safety plan.
- w. Plans for hazard communication program must include:
- 1) A list of hazardous chemicals known to be present
 - 2) Methods used to inform employees of the hazards
 - 3) Containers must be present and labeled
 - 4) MSDS for each hazardous chemical on site.

Appendix A to Attachment C

Project Site Safety Plans

The contractor will not be allowed to start work until they have demonstrated the existence of a safety program and sufficient planning that will ensure that they can work safely at Auburn University. If any of the items presented or discussed at the Pre-Construction meeting or in subsequent review of the project site specific safety plan, result in the Auburn University project manager determining that the contractor has not planned the work sufficiently to work safely, they will not be allowed to start work until they have adequately planned the work. Any delays or costs, resulting from inadequate safety planning will be the responsibility of the contractor.

Appendix B to Attachment C

Activity Hazard Analysis

1. Prior to beginning ***EACH MAJOR PHASE OF WORK***, an activity hazard analysis (AHA) shall be prepared by the contractor performing that work. The contractor will not be allowed to start work on this major phase of work until they have demonstrated the existence of an activity hazard analysis (AHA) and sufficient planning that will help ensure that they can work safely on this activity. Each of these (AHA's) shall be submitted to the Auburn University Project Manager.

The analysis will:

- Define the activity being performed
- Identify the sequence of work to be accomplished
- Identify the specific hazards that are anticipated
- Identify the control measures that shall be implemented to reduce each hazard to an acceptable level

2. Hazard analysis shall identify the principal steps to be accomplished in sequence to accomplish the operations. Equipment used in the operation shall be listed on the hazard analysis form. Inspection requirements for the equipment and machinery shall be listed on the hazard analysis form. Each step shall be analyzed to identify its potential hazards and a recommended control shall be identified to reduce the hazard to an acceptable level.

3. The contract documents will identify the minimum Activity Hazard Analyses that must be submitted on this project. The Prime Contractor shall submit other AHAs, as required to ensure the safe execution of its work and the work of its subcontractors. Auburn University has authority to order the Prime Contractor to submit additional AHAs as they deem necessary.

4. When the Site Specific Safety Plan is initially submitted by the Prime Contractor for the project, the Prime Contractor shall list all of the AHAs it proposes to submit. The Auburn University Project Manager will review this list for completeness, and may require additional AHAs to be submitted. The Auburn University Project Manager will maintain a log of required AHAs and track their receipt and approval throughout the course of the contract.

5. Detailed, completed AHAs shall be submitted by the Prime Contractor no less than 30 days prior to the start of the activity or major phase of work.

6. The performance of the activity in a safe manner is the sole responsibility of the Prime Contractor. The review of the AHA by the Auburn University Project Manager is to gauge the completeness of the safety planning effort by the Prime Contractor and their preparedness to mitigate the hazards and execute the work safely in accordance with contract requirements. The review of the AHA by Auburn University in no ways implies or conveys liability or responsibility from the Prime Contractor to Auburn University.

7. The preferred format for the AHAs is attached to this Appendix.

Appendix B to Attachment C

Activity Hazard Analysis

Work Phase:		Activity
Analyzed by/Date		Reviewed by/Date
Principal Steps Taken	Potential Hazards	Recommended Controls or Risk Mitigation Measures to be
Identify the potential principal steps involved and the sequence of work activities	Analyze each principal step for its potential hazard.	Develop specific controls for each
Equipment to be used	Inspection Requirements	Training Requirements
List equipment/machinery to be used in conducting the Work activities	List inspection requirement for equipment/machinery listed	Determine requirement for worker training. Include Hazard Communication/Fall Protection Confined Space/Lockout & Tagout/Asbestos

Appendix B to Attachment C Activity Hazard Analysis

Work Phase:		Activity
Analyzed by/Date		Reviewed by/Date
Principal Steps Taken	Potential Hazards	Recommended Controls or Risk Mitigation Measures to be
Equipment to be used	Inspection Requirements	Training Requirements

SURETY'S BOND NUMBER

PERFORMANCE BOND

USE BLACK INK ONLY

- (1)
- (2) The **PRINCIPAL** (Name and address of Contractor as appear in the Construction Contract)

Phone:

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

Phone:

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

Auburn University
 c/o Facilities Management
 West Samford Avenue
 Auburn University, Alabama 36849-5514
 Phone: 334/844-9266

- (5) The **PENAL SUM** of this Bond (the Contract Sum)
 _____ (\$_____)

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

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

AU Project Name:

AU Project No.:

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.

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 _____.

(9) **ATTEST:**

CONTRACTOR as PRINCIPAL:

By _____

Name & Title: _____

(10) **Countersigned by
Alabama Resident Agent for Surety:**

SURETY:

By _____

By _____

Name

Name and Title

Address

(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

- (1)
- (2) The **PRINCIPAL** (Name and address of Contractor, same as appears in the Construction Contract)

Phone:

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

Phone:

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

Auburn University
c/o Facilities Management
West Samford Avenue
Auburn University, Alabama 36849-5514
Phone: 334/844-9266

- (5) The **PENAL SUM** of this Bond (the Contract Sum)
- _____ (\$_____)

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

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

AU Project Name:

AU Project No.:

- 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.
- 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.

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 _____.

(9) **ATTEST:**

CONTRACTOR as PRINCIPAL:

By _____

Name & 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.

GENERAL CONDITIONS of the CONTRACT

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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 are 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 include 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

Except as otherwise provided in the Contract Documents, a sufficient number of copies of all Drawings and Project Manuals reasonably necessary for the execution of the Work 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 is 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 to any part of the construction or site that may cause damage or endanger safety.
- 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 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 with a Construction Change Directive 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 ½" 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 is 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 arises 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 Employers' 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 attorney's 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, whoever 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 it's 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

**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

SUPPLEMENTAL GENERAL CONDITIONS

Modifications: The following modifications and additions are hereby made to the printed GENERAL CONDITIONS (ABC Form C-8 August 2001):

Article 6, B: SUPERINTENDENT

Add:

The Contractor shall submit within five (5) days following receipt of Bids, to the Architect, the name(s) of the Superintendent(s) who will be in charge at each work site, along with the qualifications and experience of each.

NOTE: By Submission of a Proposal the Bidder agrees that the Owner or Architect may reject a proposed Superintendent with or without a stated reason with no recourse to the Contractor.

Article 6. C: EMPLOYEES

Add:

All labor shall be performed in the best and most workmanlike manner by persons skilled in their respective assignments or trades. Workmen whose work is unsatisfactory to the Owner, the Architect, or the Director, or who are considered unfit or unskilled, or otherwise objectionable, shall be dismissed upon notice from the Owner, the Architect, or the Director.

Article 12. PROGRESS SCHEDULE

Add:

For all projects with durations of more than 90 calendar days or of greater than \$500,000.00 cost of the work, the Contractor shall provide a comprehensive construction schedule of appropriate detail and format, to monitor all aspects of the progress of the project (in addition to the ABC Form C-11). The exact format will be adjusted for each project based upon such relevant factors as: duration, complexity, number of prime contracts, anticipated critical delivery items, critical project deadlines and / or milestones, etc.

Article 14: Safety and Protection of Persons and Property

Add Paragraph (K)

a. The contractor will comply with all requirements of the Auburn University Safety Specifications. See the following attachments for all applicable requirements that are made a part of this contract.

1. ATTACHMENT C: HEALTH AND SAFETY - "Auburn University Safety Specification - Construction Contracts - MultiPrime Contract"

2. Appendix A to Attachment C -"Project Site Safety Plan"
3. Appendix B to Attachment C -"Activity Hazard Analysis"

Article 19: CHANGES IN THE WORK

A. GENERAL

- a. Delete the first sentence. Replace with the following: The Owner may at any time direct the Contractor with a Construction Change Directive 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.

ADD (7) Change Proposal Requirements

- a. Auburn University continually and diligently works to communicate clearly the general procedures, processes, reviews, forms, tips, and suggestions for submitting Change Proposal Requests. Ensure you review this information prior to bidding the project!
- b. Contractor shall be required to submit ALL change proposals using the "Change Proposal Recap Sheet".
- c. To access the Change Proposal Requirements, go to the following link and follow the instructions from there:
<http://www.auburn.edu/administration/facilities/contractor-documents/change-order/index.html>

Article 23. DELAYS

Add:

Calculation of rain days shall be in accordance with Auburn University's Policy for Granting Time Extensions Due to Rain. Said policy is as follows:

UNIVERSITY'S POLICY FOR GRANTING TIME EXTENSIONS DUE TO RAIN Auburn University

1. Obtain precipitation data from the A.W.I.S. Weather Service located at the Auburn Opelika Robert G. Pitts Airport / airport code AUO.
2. A rain day is considered to be any day with a measured precipitation of more than 0.1 inch.
3. Determine the average number of days per month with a measured precipitation of more than 0.1 inch for the five-year period preceding the start of the project in question.
4. Compare the number of rain days during each month of the project contract time period to the monthly five-year average. The Contractor may be granted an extension for rain days during the contract period which exceeded the five year average. The number of days granted will vary for different types of projects, depending upon the amount of inside or outside work. Refer to the following classifications for various time extensions pertinent to typical project types. No time will be deducted from the contract period for months when rain days are less than the five-year average.

- Class I:** Low Slope (1:12 or less) roof replacement on existing building – 2 days granted for each rain day beyond the five year average.
- Class II:** Sitework, paving underground utilities – 3 days granted for each rain day beyond the five year average.
- Class III:** New Building and steep roof replacement (greater than 1:12) – 1 day granted for each rain day beyond the five year average.
- Class IV:** Renovation of exiting building with some outside work - .5 days granted for each rain day beyond the five year average.
- Class V:** Renovation of existing building with no outside work – 0 days granted for each rain day beyond the five year average.
5. If time extensions are granted, they shall be included in the next subsequent change order.
 6. Rain Day classification will be Class III unless modified by Special Conditions.
 7. Reporting of rain days shall be included in each monthly schedule update.

Article 29: E, RETAINAGE

Omit paragraph (2), Insert the following:

(2) In making Partial Payments there shall be retained five (5%) percent of the estimated amount of work done plus the value of the materials stored for the work until completion of fifty (50%) percent of the Contract, after which no additional retainage will be withheld, unless the Contractor is more than ten (10%) percent behind his approved project schedule. Should the Contractor be found to be more than ten (10%) percent behind schedule, then the retainage shall remain at five (5%) percent until such time as the Contractor is back on schedule or until the project is complete whichever occurs earlier, at which time the retainage shall be reduced to a total not to exceed the calculated amount which would have been retained had the Contractor remained on schedule throughout the project.

(3) No alternative arrangements in lieu of retainage will be acceptable for this project (i.e. no securities or certificates of deposit or similar in lieu of retainage).

Article 37: CONTRACTOR'S AND SUBCONTRACTOR'S INSURANCE

A. GENERAL

(3) INSURANCE CERTIFICATES.

Delete first sentence. **Replace with the following:** The Contractor shall procure and maintain without interruption during the entire term of this contract 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) and an ISO endorsement, or industry equivalent, acceptable to the Owner, including Auburn University, its Board of Trustees, Employees and Agents as the certificate holder and Additional Insured on the General Liability, Automobile Liability and Umbrella/Excess Liability policies.

(4)(h) INSURANCE CERTIFICATES.

Delete. **Replace with the following:** Name and Address of Auburn University, its Board of Trustees, Employees, and Agents as certificate holder and additional insured.

B. INSURANCE COVERAGES

(1) Worker's Compensation and Employer's Liability Insurance

(a) Delete. **Replace with the following:** Workers' Compensation coverage shall be provided and written in accordance with 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 that the Contractor qualifies to pay its own workers' compensation claims.

(2) Commercial General Liability Insurance

(a) Add .5 Contractual Liability \$1,000,000.00
Add .6 Damage to rented Premises \$ 300,000.00

(b) .1 Delete. **Replace with the following:** The policy shall name Auburn University, its Board of Trustees, Employees and Agents, 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.

Add .3 Policy must cover all activities to be performed by the contractor.

(3) Commercial Business Automobile Liability Insurance

(a) Delete. **Replace with the following:** Commercial Business Automobile Liability which shall include coverage for bodily injury and property damage arising from the ownership, operation, maintenance, or use of any and all owned, non-owned, leased, and hired.

The Commercial Business Policy shall provide not less than \$1,000,000.00 Combined Single Limits for each occurrence.

- (b) Delete. **Replace with the following:** The policy shall name Auburn University, its Board of Trustees, Employees, and Agents, Architect, Alabama Building Commission, State Department of Education (if applicable), and their agents, consultants and employees as additional insureds.

(4) Commercial Umbrella Liability Insurance

- (c) .1 Delete. **Replace with the following:** The policy shall name Auburn University, its Board of Trustees, Employees, and Agents, Alabama Building Commission, State Department of Education (if applicable), and their agents, consultants and employees as additional insureds.
- .2 Delete. **Replace with the following:** If a Commercial Umbrella/Excess Liability Insurance is used to provide excess coverage above the Commercial General Liability, Employer's Liability, and Commercial Business Automobile Liability to satisfy the minimum limits set forth herein, the policy must be on an "occurrence" basis and must be a "Follow Form."

(5) Builder's Risk Insurance

- (a) Delete. **Replace with the following:** The Builder's Risk Policy shall be made payable to Auburn University and Contractor, as their interests may appear. The policy amount shall be Replacement Cost Coverage, equal to 100% of the contract sum with All Risk 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.
- (c) Add paragraph.
Policy shall provide coverage for flood, earthquake, building material on or off site or in transit, underground utilities, foundations and pilings.

ADD: Builder's Risk Coverage Provided by Auburn University

-Auburn University may elect to provide Builder's Risk property coverage through a commercial insurer that offers a competitive program with a scope of coverage that is understood to be comprehensive by commercial insurance standards. The commercial insurer selected by Auburn University shall have an A.M. Best rating no less than A-, Class V.

The contractor will be responsible for the deductible should a loss occur. This will be reimbursed to the University through a reduction in the

General Contractor's Payment schedule.

Following is a summary of coverage provided by Auburn University's builder's risk policy

1. Replacement Cost Coverage
2. Flood: policy limit not to exceed \$10M
3. Earthquake: policy limit not to exceed \$10M
4. Deductible: \$5,000
5. Boiler & Machinery: policy limit
6. Building materials on site: policy limit
7. Contract works in transit: \$IM
8. Underground Utilities: covered if values are reported in policy limit
9. Foundations and pilings: covered if values are reported in policy limit
10. Permission to occupy: can occupy location before fully furnished, but only with prior written authorization from the insurance earner.

Additional limits of coverage can be purchased upon request and approval by the insurance company. Addition premium will apply.

Exclusions, include but are not limited to:

1. Repair, replace or rectify contract works due to error, omission or deficiency in design, plan, specification or surveying
2. Disappearance where there is no physical evidence to indicate what happened
3. Contractor's or subcontractor's equipment, machinery, tools
4. Damage caused by nesting, infestation, or discharge of waste products or secretions of any insect or animal
5. Mechanical breakdown, other than abrupt and accidental
6. Nuclear hazard, war, or military action
7. Pollutants
8. Settling, subsidence, cracking shrinking, bulging or expansion of land, paved or concrete surfaces, foundations, pools, or structures

This summary of coverage and exclusions is not an insurance policy and should **never** be used for insurance policy interpretation. One cannot possibly address all situations; coverage will depend upon particular circumstances of the claim. Exclusions or restrictions of coverage may apply in a specific situation or coverage may be re-negotiated with different terms and conditions. For insurance policy interpretation, we recommend that you contact the Office of Risk Management and Insurance.

The contractor may review a summary of Auburn University's Builder's Risk Policy. Website address: <https://cws.auburn.edu/nns/>

(6) ADD: Professional Liability Insurance:

Professional Liability/Errors and Omissions Liability will be required if the contractor is acting as a licensed professional while performing a service for Auburn University. Licensed professionals include, but are not limited to; Architects and Engineers.

Minimum Limit	\$1,000,000 each claim
	\$2,000,000 annual aggregate

Claims made policies must include a two year reporting period or coverage must be provided for up to two (2) years after the completion of a project.

(7) ADD: Environmental Impairment Liability Insurance:

Environmental Impairment Liability Insurance will be provided if the contractor will be handling hazardous or toxic products. Contractors needing this coverage include, but is not limited to, transportation or disposal of explosives, nuclear materials, polychlorinated biphenyl (PCB) materials, pesticides, & fungicides, & oil; installation or removal of underground and above-ground storage tanks; asbestos abatement; and lead abatement.

Minimum Limit	\$1,000,000 each claim
	\$2,000,000 annual aggregate

Claims made policies must include a two year reporting period or coverage must be provided for up to two (2) years after the completion of a project.

E. WAIVERS of SUBROGATION

Delete. **Replace with the following:** 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 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 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 has an insurable interest in the property damaged. The waivers provided for in this paragraph shall not be applicable to loss or damage that occurs after final acceptance of the Work.

Add: F. **Additional Conditions:**

Impairment of Liability

In the event the insurance program required by Auburn University were to have any pending claim(s), which may limit or exhaust any aggregate limits by more than 20%, Auburn University shall be notified within thirty (30) days. Auburn University may require additional insurance or reinstatement of the limits of liability as necessary to protect the financial interest of the University.

Duty to Provide Copies of Insurance Policies

Auburn University shall be entitled, upon request and without expense, to receive copies of policies and endorsements thereto and may make any reasonable requests for deletion or revision or modification or particular policy terms, conditions, limitations, or exclusions except where policy provisions are established by law or regulations binding upon either of the parties or to underwriting on such policies.

Notice of Incident

Contractor shall inform Auburn University Risk Management and Safety of all incidents and/or accidents that occur on the Auburn University premises or that might otherwise give rise to a claim against Auburn University and shall be responsible for providing appropriate written notification. Such notification shall be provided as soon as reasonably possible but will not exceed twenty- four (24) hours after contractor is aware of the incident/accident.

Article 44, A, Permits Fees and Notices

Add paragraph (3)

(3) The contractor shall be responsible for obtaining a "Notice of Registration" from ADEM. The contractor shall provide proof of ADEM registration to the Owner prior to initiating any earthwork. The contractor shall be responsible for all monitoring, inspections, etc... to ensure to the Owner that the site is at all times in accordance with ADEM Rules and Regulations. Documentation of QCI and QCP inspections shall be provided to the Owner.

Article 51: Sign

Omit the requirement for the standard A.B.C. project sign.

Provide Auburn University sign on projects when required by the "Special Conditions". Contractors own signs are allowed but are not encouraged. No more than one **(1)** Contractor's sign (for each prime contractor, maximum size 4' x 8') may be displayed at the project site.

ADD: SMOKE-FREE CAMPUS

Policy Principles

A. Smoking is prohibited within all University buildings, facilities, grounds, University-owned vehicles, and property leased to or managed by the University with the exceptions of:

1. Controlled research, or educational, theatrical, or religious ceremonial purposes, with prior approval from the Dean or Director responsible for the facility.
2. Privately-owned vehicles and locations outside of the Auburn University campus perimeter. Smoke-Free Campus maps can be found at <https://cws.auburn.edu/map?smokefree>.

NOTE: The campus map online does not depict all property that is leased or managed by Auburn University.

B. Littering the campus with remains of disposable tobacco products is prohibited.

C. Assistance with smoking cessation for students, faculty and staff is available through the Auburn University Medical Clinic, the Harrison School of Pharmacy, and the Office of Health Promotion and Wellness Services. More information can be found at <http://auburn.edu/smokefree>.

D. Information regarding smoking and tobacco use at Auburn University Montgomery can be found within their Smoking Policy.

Applicability

This policy applies to all students, faculty, staff, consultants, contractors, and visitors.

Definitions

A. For the purpose of this policy, the Auburn University campus shall be defined as that which is contained within the legal property boundaries of all property owned, leased to or managed by the University or managed by Auburn University. More information including campus maps can be found at <https://cws.auburn.edu/map?smokefree>.

B. For the purpose of this policy "smoking" is defined as inhaling, exhaling, burning or possessing lighted tobacco products, including cigarettes, cigars, pipe tobacco and hookahs.

C. For the purpose of this policy prohibition includes electronic or e-cigarettes.

Exclusions

As noted above:

A. Smoking in University facilities will be permitted for controlled research, educational, theatrical, or religious ceremonial purposes, with prior written approval of the Dean, Director, or Department Head responsible for the facility.

B. Smoking is permitted in privately-owned vehicles (windows up) parked within the perimeter of campus.

RELEASE OF LIEN FORM

STATE OF ALABAMA

SUBJECT: _____

_____ COUNTY

MATERIAL FURNISHED: _____

We, _____ do hereby and herewith through

(Name of person signing affidavit)

(Title)

declare that all labor, bills for materials for supplies, utilities and for all other things furnished or caused to be furnished by the above between

(Name of firm)

(Name of contractor)

have been fully paid, that there are no unpaid claims or demands of Subcontractors, material, men, mechanics, laborers or others resulting from or arising out of any work done or ordered to be done by said subcontractor under the above identified contracts, and declares that the Federal and State payroll taxes and contributions for unemployment insurance, old age pensions, annuities and retirement benefits imposed or assessed under any provision of any law, State or Federal, and measured by wages, salaries or other remuneration paid by said subcontractor to employees of his own Subcontractors engaged in said work or in any operation incidental thereto, have been paid.

NOW THEREFORE, KNOW YE, that we, the undersigned, do hereby waive and release any and all lien on said above described building and premises, arising under any by virtue of the General Labor and Mechanics Lien on account of Labor or materials or both, furnished or this may hereafter be furnished by the undersigned to or on account of the said

(Name of contractor)

for said building or premises.

Subscribed and sworn to me _____
(Name of contractor)

On this _____ day of _____, _____

NOTARY PUBLIC

My commission expires: _____

(Seal)

FORM OF ADVERTISEMENT FOR COMPLETION

LEGAL NOTICE

In accordance with Chapter 1, Title 39, Code of Alabama, 1975, notice is hereby given that _____, 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.

SPECIAL CONDITIONS

1. TIME OF COMPLETION

Work in this contract shall be substantially completed within 120 calendar days of the date stated in the Notice To Proceed.

2. LIQUIDATED DAMAGES

To follow Article 49 of the ABC Form C-8, General Conditions.

3. PROJECT SIGN:

To be located near the project site, per direction of the Campus Architect.

4. RAIN DAY CLASS:

Rain day classification to be Class III.

5. BUILDER'S RISK INSURANCE:

Per Auburn University's Supplemental Conditions and General Conditions.

6. STATE OF ALABAMA BUILDING COMMISSION CHAPTER 170X – 8: COLLECTION OF USER FEES:

Each bidder is not required to include the cost for the Permit Fees required by the State of Alabama Building Commission. Contact the Alabama Building Commission or visit their website at: <http://www.bc.state.al.us>

7. EXISTING SITE:

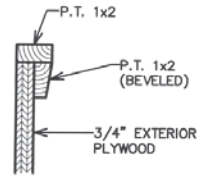
Each Bidder agrees to accept the Site “as-is”; all verification of existing site conditions and items, as well as, coordination of the Work with the Site Infrastructure Package (AU#14-178) are the responsibility of the Bidder.

LETTER TYPES

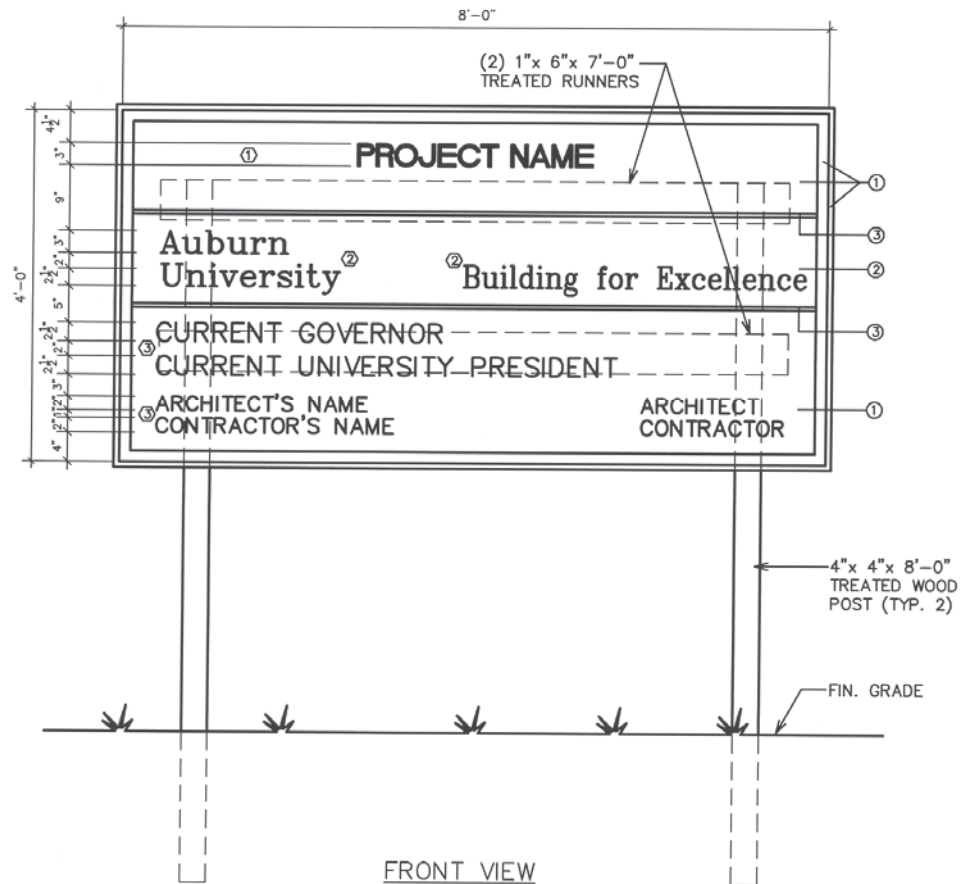
- ① HELVETICA MEDIUM (COLOR 3)
- ② UNIVERSITY ROMAN (COLOR 3)
- ③ HELVETICA LIGHT (COLOR 3)

COLORS

- ① PITTSBURG D4752 "GREY VELVET" (EXTERIOR)
- ② PITTSBURG N7243 "EGYPTIAN RUST" (EXTERIOR)
- ③ PITTSBURG P2537 "BLOSSOM WHITE" (EXTERIOR)



DETAIL OF WOOD SURROUND
N.T.S.



FRONT VIEW

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 UNPAINTED EXTERIOR 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.

GENERAL CONTRACTOR'S ROOFING GUARANTEE

B. C. Project No. _____

Project Name & Address	Project Owner(s) & Address

General Contractor's Name, Address, & Telephone Number	EFFECTIVE DATES OF GUARANTEE
	Date of Acceptance:
	Date of Expiration:

1. The General Contractor does hereby certify that the roofing work included in this contract was installed in strict accordance with all requirements of the plans and specifications and in accordance with approved roofing manufacturers recommendations.
2. The General Contractor does hereby guarantee the roofing and associated work including but not limited to all flashing and counter flashing both composition and metal, roof decking and/or sheathing; all materials used as a roof substrate or insulation over which roof is applied; promenade decks or any other work on the surface of the roof; metal work; gravel stops and roof expansion joints to be absolutely watertight and free from all leaks, due to faulty or defective materials and workmanship for a period of five (5) years, starting on the date of substantial completion of the project. This guarantee does not include liability for damage to interior contents of building due to roof leaks, nor does it extend to any deficiency which was caused by the failure of work which the general contractor did not damage or did not accomplish or was not charged to accomplish.
3. Subject to the terms and conditions listed below, the General Contractor also guarantees that during the Guarantee Period he will, at his own cost and expense, make or cause to be made such repairs to, or replacements of said work, in accordance with the roofing manufacturers standards as are necessary to correct faulty and defective work and/or materials which may develop in the work including, but not limited to: blisters, delamination, exposed felts, ridges, wrinkles, splits, warped insulation and/or loose flashings, etc. in a manner pursuant to the total anticipated life of the roofing system and the best standards applicable to the particular roof type in value and in accordance with construction documents as are necessary to maintain said work in satisfactory condition, and further, to respond on or within three (3) calendar days upon proper notification or leaks or defects by the Owner or Architect.

- A. Specifically excluded from this Guarantee are damages to the work, other parts of the building and building contents caused by: (1) lightning, windstorm, hailstorm and other unusual phenomena of the elements; and (2) fire. When the work has been damaged by any of the foregoing causes, the Guarantee shall be null and void until such damage has been repaired by the General Contractor, and until the cost and expense thereof has been paid by the Owner or by the responsible party so designated.
- B. During the Guarantee Period, if the Owner allows alteration of the work by anyone other than the General Contractor, including cutting, patching and maintenance in connection with penetrations, and positioning of anything on the roof, this Guarantee shall become null and void upon the date of said alterations. If the owner engages the General Contractor to perform said alterations, the Guarantee shall not become null and void, unless the General Contractor, prior to proceeding with the said work, shall have notified the Owner in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate the work, thereby reasonably justifying a termination of this Guarantee.
- C. Future building additions will not void this guarantee, except for that portion of the future addition that might affect the work under this contract at the point of connection of the roof areas, and any damage caused by such addition. If this contract is for roofing of an addition to an existing building, then this guarantee covers the work involved at the point of connection with the existing roof.
- D. During the Guarantee period, if the original use of the roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray cooled surface, flooded basin, or other use of service more severe than originally specified, this Guarantee shall become null and void upon the date of said change.
- E. The Owner shall promptly notify the General Contractor of observed, known or suspected leaks, defects or deterioration, and shall afford reasonable opportunity for the General Contractor to inspect the work, and to examine the evidence of such leaks, defects or deterioration.

IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, 20 _____.

General Contractor's Authorized Signature

Typed Name and Title

SECTION 01 1000

SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Facilities Building 8 – New Facility for Waste Reduction, Mail Services & Service Support
- B. Owner's Name: Auburn University
- C. Architect's Name: Kahn South, Inc.
- D. The Waste Reduction & Recycling (WWRD) Facility Project consists of a new single-story Steel Building of approximately 5,000 SF to accommodate functional program elements for the AUFM Waste Reduction & Recycling and Service Support Departments, a new covered Storage Area, and new loading dock. The anticipated site is to be located within the AUFM Complex, at the southeast corner or the existing parking lot.
 - A. AU Project 13-194: AU Facilities Building #8
 - a. All work associated with the building itself, including all foundations, loading dock, retaining wall, and (2) concrete paving in-fill areas
 - b. All sub-grade site work required beneath the building pad, loading dock, retaining wall, exterior concrete paving at north overhead door, and to a distance from the face of the aforementioned elements as specified on Sheet A0.0.
 - c. All utilities from the building footprint to existing utility stub-outs.
 - d. Site improvements fencing, concrete walks, etc.) as shown on Sheet A0.0.

1.02 DESCRIPTION OF WORK

- A. Project Criteria is described in the specifications and drawings.
- B. Scope of alterations work is shown on drawings.
- C. Contractor to accept site "as-is"; verify existing site conditions and items (whether shown on plans or not) and coordinate all work. For reference purposes, copies of Site Infrastructure Package (AU #14-178) can be obtained from AU Facilities.

1.03 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

1.04 CONTRACTOR USE OF SITE AND PREMISES

- A. Arrange use of site and premises to allow:
 - 1. Owner occupancy.
 - 2. Work by Others.
 - 3. Phasing of the Work.
- B. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.

C. Time Restrictions:

1. Limit conduct of especially noisy interior work to the hours of 6 pm-8 am.

1.05 WORK SEQUENCE

- A. Coordinate construction schedule to facilitate Owner activation of facility.

END OF SECTION

SECTION 01 2000

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SCHEDULE OF VALUES

- A. Submit a printed schedule on AIA Form G703 - Application and Certificate for Payment Continuation Sheet. Contractor's standard form or electronic medial printout will be considered.
- B. Submit Schedule of Values in duplicate within 5 days after date established in Notice to Proceed.
- C. 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.
- D. Include in each line item, the amount of Allowances specified in this section.
- E. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- F. Revise schedule to list approved Change Orders, with each Application For Payment.

1.02 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Present required information in typewritten form.
- C. Form: AIA G702 Application and Certificate for Payment and AIA G703 - Continuation Sheet including continuation sheets when required.
- D. 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.
- E. Execute certification by signature of authorized officer.
- F. 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.
- G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work. Include a breakdown of the items of work in the Change Order and the schedule of values for each item of work.
- H. Submit 6 copies of each Application for Payment.
- I. Include the following with the application:
 - 1. Transmittal letter as specified for Submittals in Section 01 3000.
 - 2. Construction progress schedule, revised and current as specified in Section 01 3000.
 - 3. Current construction photographs specified in Section 01 3000.
 - 4. Partial release of liens from major Subcontractors and vendors.
 - 5. Affidavits attesting to off-site stored products.

- J. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.03 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. 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.
- D. For changes for which advance pricing is desired, Architect will issue a document which includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 5 days.
- E. 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 and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01600.
- F. 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 change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- G. 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.

- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. 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.
- J. 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.
- K. Promptly enter changes in Project Record Documents.

1.04 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 7000.

END OF SECTION

SECTION 01 2200

UNIT PRICES

PART 1 GENERAL

1.01 COSTS INCLUDED

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

1.02 UNIT QUANTITIES SPECIFIED

- A. Quantities indicated in the Bid Form, individual specification sections, or drawings are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.03 MEASUREMENT OF QUANTITIES

- A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. Measurements and quantities will be checked by Design-Builder and Architect.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.
- D. Measurement Devices:
 - 1. Weigh Scales: Inspected, tested and certified by the applicable state Weights and Measures department within the past 6 months.
 - 2. Metering Devices: Inspected, tested and certified by the applicable State department within the past 6 months.
- E. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
- F. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
- G. Measurement by Area: Measured by square dimension using mean length and width or radius.
- H. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
- I. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.
- J. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.
- K. Contractor's Engineer Responsibilities: Sign surveyor's field notes and keep duplicate field notes to calculate and certify quantities for payment purposes.

1.04 PAYMENT

- A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Contractor, multiplied by the unit price.
- B. Payment will not be made for any of the following:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined as unacceptable before or after placement.
 - 3. Products not completely unloaded from the transporting vehicle.

4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected Products.

1.05 DEFECT ASSESSMENT

- A. Replace Work, or portions of the Work, not conforming to specified requirements.
- B. If, in the opinion of Contractor and Architect, it is not practical to remove and replace the Work, Contractor will direct one of the following remedies:
 1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Contractor after review and recommendations by the Engineer.
 2. The defective Work will be partially repaired to the instructions of the Architect, and the unit price will be adjusted to a new unit price at the discretion of contractor after review and recommendations by the Engineer.
- C. The individual specification sections may modify these options or may identify a specific formula or percentage price reduction.
- D. The authority of Architect to assess the defect and the authority of the Contractor to identify payment adjustment is final.

1.06 SCHEDULE OF UNIT PRICES

<u>Description</u>	<u>Unit</u>	<u>Cost</u>	<u>Quantity</u>
1. Excavation and haul-off of sub-grade material	Cubic Yard	\$ _____	<u>1</u>
2. Haul-in, placement and compaction of sub-grade material	Cubic Yard	\$ _____	<u>1</u>
3. Placement of reinforced concrete footings: prep base, form, and placement.	Cubic Yard	\$ _____	<u>1</u>
4. Place silt fencing including all trenching, staking, and placement	Linear Feet	\$ _____	<u>1</u>
5. Placement of 4" concrete pavement: prep base, form, and placement.	Square Feet	\$ _____	<u>36</u>
6. Provide and install new concrete curb stop	Curb	\$ _____	<u>1</u>
7. Provide and install 1 bollard to match design reflected on sheet A1.0 for a concrete paving condition.	Bollard	\$ _____	<u>1</u>
8. Provide and install 1 roof anchor post, Miller Fusion #X10002, as indicated on Sheet A1.2.	Roof Post	\$ _____	<u>1</u>

END OF SECTION

SECTION 01 2300

ALTERNATES

PART 1 GENERAL

- A. Description of alternates.

1.01 ACCEPTANCE OF ALTERNATES

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

1.02 SCHEDULE OF ALTERNATES

Alternate No.1:	Provide canopy over Loading Dock; to include PEMB framing, roof system, trims & flashings. Also include Pre-action fire protection system to serve canopy. Base Bid to include gutter & downspouts along building face, and fire protection system to serve building interior.
Alternate No.2:	Add interior metal liner panels on all walls of Warehouse 115. Base Bid to include exposed PEMB framing & insulation on (3) perimeter walls and gypsum board on metal stud partition, full-height. Do not omit gypsum board in Alternate.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 3000

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary
- B. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.
- C. Section 01 7000 - Execution Requirements - Alteration Projects: Additional coordination requirements.
- D. Section 01 7800 - Closeout Submittals: Project record documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Owner will schedule a meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Contractor.
 - 3. Major Systems Sub-Contractor.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of Subcontractors, unit prices, labor rates, list of Products, schedule of values, and detailed design and construction schedule.
 - 5. Designation of personnel representing the parties to Contract.
 - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 7. Scheduling.
- D. Architect will record minutes and distribute copies within two business days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
- E. Record minutes and distribute copies within three days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.02 SITE MOBILIZATION MEETING

- A. Owner will schedule a meeting at the Project site prior to Contractor occupancy.
- B. Attendance Required:
 - 1. Contractor.
 - 2. Owner.
 - 3. Architect.

4. Contractor's Superintendent.
 5. Major Subcontractors.
- C. Agenda:
1. Use of premises by Owner and Contractor.
 2. Owner's requirements and partial occupancy prior to completion.
 3. Construction facilities and controls.
 4. Temporary utilities.
 5. Survey and existing conditions layout.
 6. Security and housekeeping procedures.
 7. Schedules.
 8. Application for payment procedures.
 9. Procedures for testing.
 10. Procedures for maintaining record documents.
 11. Requirements for start-up of equipment.
 12. Inspection and acceptance of equipment put into service during construction period.
- D. Record minutes and distribute copies within two business days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

- A. Owner will schedule meetings, prepare agenda with copies for participants, and preside at meetings throughout progress of the Work at not more than bi-monthly intervals.
- 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 which 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. Owner will record minutes and distribute copies within two business days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE

- A. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- B. Within 5 business 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.
- C. Within 5 business days after joint review, submit complete schedule.
- D. Submit updated schedule with each Application for Payment.

3.05 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.
- C. Photography Type: Digital; electronic files.
- D. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Architect.
- E. Take photographs as evidence of existing project conditions as follows:
 - 1. Interior views: As necessary to document all areas where work is to be performed..
- F. Views:
 - 1. Consult with Architect for instructions on views required.
 - 2. Provide factual presentation.
 - 3. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
 - 4. Point of View Sketch: Provide sketch identifying point of view of each photograph.
- G. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
 - 1. Delivery Medium: Via email.
 - 2. File Naming: Include project identification, date and time of view, and view identification.
 - 3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
 - 4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
 - 5. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

3.06 COORDINATION DRAWINGS

- A. Review drawings prior to submission to Architect.

3.07 REQUEST FOR INFORMATION PROCEDURES

- A. Contractor may submit Request for Information (RFI) to Architect seeking clarification or interpretation of conflicts, errors, discrepancies or ambiguities in Contract Documents
 - 1. Must be submitted in writing. Oral RFI will not be accepted.
 - a. Project delay caused by Architect's refusal to accept oral RFI will be attributed solely to Contractor.
 - 2. Limit each RFI to a single issue.
 - 3. Include on RFI form:
 - a. Chronological number of RFI.
 - b. Requestor's name.
 - c. Contractor making request.
 - d. Drawing number and detail number.
 - e. Specification section and page numbers (if applicable).
 - f. Concise and clear statement of request for information identifying conflict, error, discrepancy or ambiguity giving rise to RFI.

- g. If any change in Contract Amount or Contract Time will result from RFI.
- B. If RFI is in compliance with this procedure and is sufficiently clear to allow a response, Architect will timely formulate response on designated portion of RFI form.
- C. Architect will determine, based on their judgment, whether response necessitates an extra or adjustment to Contract Amount or Contract Time and will be noted on RFI form.
 - 1. RFI is not a Change Order.
 - 2. Under no circumstance is RFI response to be considered an authorization to depart from Contract Documents or to perform extra work.
 - 3. If a change, extra or adjustment to Contract Documents is necessary, appropriate contract procedures must be followed.
- D. Architect will forward response to requester with copies to file, Project Engineer, Resident Project Representative, Owner, and Construction Manager (if applicable).

3.08 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 - 1. Design 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.
 - 1. When required by Specification, submit to Architect for review, materials and finishes to be used in execution of Work.
 - 2. Size: Sufficient to be representative or as specified.
 - 3. Quantity: 3 copies unless specified otherwise in a Section.
 - 4. Submit before Work is commenced and in ample time to permit review.
 - 5. Materials furnished and finishes applied shall be fully equal to accepted samples.
 - 6. Contractor's furnishing or Architect's acceptance of samples shall not relieve Contractor of obligation to comply with Contract.

3.09 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - 1. Product data.
 - 2. Design data.
 - 3. Performance data.
 - 4. Certificates.
 - 5. Test reports.
 - 6. Inspection reports.
 - 7. Manufacturer's instructions.
 - 8. Manufacturer's field reports.
 - 9. Other types requested.
- B. Architect will receive and return Contractor Submittal with each item marked as follows:
 - 1. I - Information will be recorded, further action not required.
 - 2. NA - Not acceptable.

3.10 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit at project closeout:
 - 1. Project record documents.
 - a. Complete set of submittals of documents as finally reviewed by Owner, with subsequent modifications indicated by Owner, or showing Work as completed.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Bonds.
 - 5. Certificates.
 - 6. Other types as requested.
- B. Submit for Owner's benefit during and after project completion.

3.11 NUMBER OF COPIES OF SUBMITTALS

- A. Documents for Review:
 - 1. Submit (1) electronic document in PDF format and 3 hard copies.
 - 2. For shop drawings 11" x 17" or larger, submit (2) full-size paper copies.
- B. Documents for Information: Submit two copies.
- C. Documents for Project Closeout: Make 1 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. Size: Sufficient to be representative or as specified.
 - 2. Quantity: 3 copies unless specified otherwise in a Section.
 - 3. After review, produce duplicates.
 - 4. Submit before Work is commenced and in ample time to permit review.
 - 5. Materials furnished and finishes applied shall be fully equal to accepted samples.
 - 6. Retained samples will not be returned to Contractor unless specifically so stated.

3.12 SUBMITTAL PROCEDURES

- A. Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 - 3. Submittals schedule: Provide a list of submittals including estimated date of receipt and time requirements for scheduled performance of related construction activities.
 - 4. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - a. Initial Review: Allow 10 business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - b. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

- c. Resubmittal Review: Allow 10 business days for review of each resubmittal.
 - d. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 20 business days for initial review of each submittal.
 - e. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 10 business days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- B. General Requirements.
 - 1. Label with project name, Architect's name and job number, Contractor's name, and subcontractor's name.
- C. Contractor Transmittal.
 - 1. Transmit submittals using Contractor Transmittal or Internet online form at www.albertkahn.com under "Project Access." Instructions for use of the online form are available at the same location.
 - 2. Forward to Architect.
 - 3. Multiple items from one or more Subcontracts may be submitted on one Contractor Transmittal.
 - 4. Submittal Number: Number original submittals consecutively, i.e., 001, 002, 003.
 - 5. Resubmittal Number: Original transmittal number with letter, i.e., 001A, 001B.
 - 6. Submitter: Company name of Contractor performing work.
 - 7. Transmitter: Company name of firm submitting to Architect.
 - 8. Pretransmittal Examination.
 - a. Transmitter: Examine submittals for conformance to Contract Documents prior to forwarding to Architect.
 - b. Attest to that examination by signature and date.
 - 9. Description.
 - a. List each item or drawing separately on its own line.
 - b. Indicate R for Review or I for Information in Type column.
 - c. Architect will complete Review Code and Comments columns and return Contractor Transmittal.

END OF SECTION

SECTION 01 3216

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 RELATED SECTIONS

- A. Section 01 1000 - Summary: Work sequence.

1.02 REFERENCES

- A. AGC (CPSM) - Construction Planning and Scheduling Manual; Associated General Contractors of America; 2004.
- B. M-H (CPM) - CPM in Construction Management - Project Management with CPM, O'Brien, McGraw-Hill Book Company; 2006.

1.03 SUBMITTALS

- A. Within 5 days after date established in Notice to Proceed, 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 5 days.
- C. Within 10 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.
- D. Within 5 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.
- F. Submit the number of opaque reproductions that Contractor requires, plus two copies which will be retained by the Architect.
- G. Submit under transmittal letter form specified in Section 01 3000.

1.04 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.

1.05 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Sheet Size: Multiples of to a maximum 11 x 17.
- C. 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 1000.
- 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. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, Products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- I. Indicate delivery dates for major components and shop drawings.
- J. Coordinate content with schedule of values specified in Section 01 2000.
- K. 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 Contractor 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 2 days.

3.05 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.

- F. Submit reports required to support recommended changes.
- G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect including the effects of changes on schedules of separate contractors.

3.06 DISTRIBUTION OF SCHEDULE

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

END OF SECTION

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittal procedures.
- B. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.02 REFERENCE STANDARDS

- A. ASTM C 1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2001.
- B. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2006a.
- C. ASTM C 1093 - Standard Practice for Accreditation of Testing Agencies for Unit Masonry; 2006.
- D. ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2004a.
- E. ASTM E 329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing; 2007.
- F. ASTM E 543 - Standard Specification for Agencies Performing Nondestructive Testing; 2006.

1.03 SUBMITTALS

- A. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.
- B. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Conformance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
- C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product 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.

- D. 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.
- E. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
 - 1. Submit report in duplicate 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.

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. Contractor shall employ and pay for services of an independent testing agency to perform specified testing.
- B. As indicated in individual specification sections, Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- D. Contractor Employed Agency:
 - 1. Testing agency: Comply with requirements of ASTM E 329, ASTM E 548, ASTM E 543, ASTM C 1021, ASTM C 1077, and ASTM C 1093.
 - 2. Inspection agency: Comply with requirements of ASTM D3740, ASTM E329, and ASTM E548.
 - 3. Laboratory: Authorized to operate in Alabama.
 - 4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
 - 5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. 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 MOCK-UPS

- A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be a comparison standard for the remaining Work.
- D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.

3.03 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.

3.04 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 which require testing, along with proposed mix designs.
 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

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 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 01 5213 - Field Offices.
- B. Section 01 5500 - Vehicular Access and Parking.

1.02 REFERENCES

- A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.

1.03 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.
- C. At end of construction, return facilities to same or better condition as originally found.

1.04 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.05 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Materials shall be structurally sound, in good repair, clean, and suitable for intended use.
 - 1. Framing: Metal gypsum board framing or fire-treated wood with fire resistance rating of not less than Class B.
 - 2. Gypsum board: Not less than 1/2 inch thick, fire-rated Type X.
 - 3. Paint: Water-based.
- C. Temporary Partitions.
 - 1. Erect before fit-out construction is started.
 - 2. Studs: Framing, size required by height, space 24 inches on center.
 - 3. Sill and head members.
 - 4. Cross bridging for rigidity.
 - 5. Securely fasten members together.
 - 6. Securely anchor to and brace against existing construction.
 - 7. Cover with gypsum board.
 - 8. Tape and spackle joints.
 - 9. Spackle fastener locations.
 - 10. Include temporary doors.
 - 11. Paint surfaces exposed to view from Owner-occupied areas with 2 coats.
 - 12. When no longer required, dismantle and remove.

- D. Temporary Doors.
 - 1. Security, locks and keys for each door.
 - 2. Keys: One to each person authorized by Owner.

1.06 VEHICULAR ACCESS AND PARKING - See Section 01 5500

- A. Coordinate access and haul routes with governing authorities and Owner.
- B. Provide and maintain access to fire hydrants, free of obstructions.

1.07 WASTE REMOVAL

- A. See Section 01 7419 - Waste Management, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.08 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. 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 5213

FIELD OFFICES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: use of premises and responsibility for providing field offices.
- B. Section 01 5000 - Temporary Facilities and Controls:

1.02 USE OF EXISTING FACILITIES

- A. Designated existing spaces may be used for field offices: Coordinate with the Owner for a designated area for field office.

PART 2 PRODUCTS

2.01 Contractor OFFICE AND FACILITIES

- A. Size: For Contractor's needs and to provide space for project meetings.
- B. Furnishings in Meeting Area: Conference table and chairs to seat at least eight persons; racks and files for Contract Documents, submittals, and project record documents.
- C. Other Furnishings: Contractor's option.
- D. Equipment: Six adjustable band protective helmets for visitors, one 10 inch outdoor weather thermometer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.
- B. Employee Residential Occupancy: Not allowed on Owner's property.

3.02 MAINTENANCE AND CLEANING

- A. Weekly janitorial services for offices; periodic cleaning and maintenance for offices.

END OF SECTION

SECTION 01 5500

VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: access to site, work sequence, and occupancy.

PART 2 PRODUCTS

2.01 SIGNS, SIGNALS, AND DEVICES

- A. Automatic Traffic Control Signals: As approved by local jurisdictions.
- B. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.
- C. Flag Person Equipment: As required by local jurisdictions.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clear areas, provide surface drainage of road, parking, area premises, and adjacent areas.

3.02 ACCESS ROADS

- A. Use of designated existing on-site streets and driveways for construction traffic is permitted.
- B. Tracked vehicles not allowed on paved areas.
- C. Location as approved by Auburn University.
- D. Provide unimpeded access for emergency vehicles. Maintain 20 foot width driveways with turning space between and around combustible materials.
- E. Provide and maintain access to fire hydrants free of obstructions.

3.03 PARKING

- A. Use of designated areas of existing parking facilities by construction personnel is permitted.
- B. Do not allow heavy vehicles or construction equipment in parking areas.

3.04 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.
- B. Monitor parking of construction personnel's vehicles. Maintain vehicular access to and through parking areas.
- C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.05 FLAG PERSONS

- A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

3.06 FLARES AND LIGHTS

- A. Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.07 HAUL ROUTES

- A. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.
- B. Confine construction traffic to designated haul routes.
- C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

3.08 TRAFFIC SIGNS AND SIGNALS

- A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
- B. Install and operate traffic control signals to direct and maintain orderly flow of traffic in areas under CONTRACTOR's control, and areas affected by CONTRACTOR's operations.
- C. Relocate as Work progresses, to maintain effective traffic control.

3.09 MAINTENANCE

- A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, Products, mud, snow, and ice.
- B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.10 REMOVAL, REPAIR

- A. Repair existing facilities damaged by use, to original condition.
- B. Remove equipment and devices when no longer required.
- C. Repair damage caused by installation.

END OF SECTION

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Lists of products to be removed from existing building.
- B. Section 01 4000 - Quality Requirements: Product quality monitoring.
- C. Section 01 7419 - Waste Management: Waste disposal requirements potentially affecting packaging and substitutions.

1.02 SUBMITTALS

- A. Refer to Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. 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.
- C. 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.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
- 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.
- C. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. Do not use products having any of the following characteristics:
 - 1. Made using or containing CFC's or HCFC's.
 - 2. Made of wood from newly cut old growth timber.
- C. Where all other criteria are met, Contractor shall give preference to products that:
 - 1. Are extracted, harvested, and/or manufactured closer to the location of the project.
 - 2. Have longer documented life span under normal use.
 - 3. Result in less construction waste.
- D. Provide interchangeable components of the same manufacture for components being replaced.

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 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Provide spare parts, maintenance, and extra products of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION 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 10 days after date established in Notice to Proceed.
- C. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.
- D. Document each request with provided form and 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 which may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
- 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.
- G. Substitution Submittal Procedure.
 - 1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
 - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
 - 3. The Architect will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-SUPPLIED PRODUCTS

- A. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities.
 - 1. Review Owner reviewed shop drawings, product data, and samples.

2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

- A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- B. Transport and handle products in accordance with manufacturer's instructions.
- C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
- F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 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. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- H. Prevent contact with material that may cause corrosion, discoloration, or staining.
- I. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- J. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
 1. Touch-up and repair finish where marred or damaged, leaving surface in good condition at Project completion.

END OF SECTION

CSI Form 1.5C**SUBSTITUTION
REQUEST**
(During the Bid Period)

Project: Auburn University Facilities Bldg. 8 Substitution Request Number: _____
AU Project No. 13-194 From: _____
To: Kahn South, Inc. Date: _____
Patrick Davis, Jr. FAIA A/E Project Number: 03322.00
Re: _____ Contract For: _____
Specification Title: _____ Description: _____
Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
Manufacturer: _____ Address: _____ Phone: _____
Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

A/E's REVIEW AND ACTION

- ☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
- ☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
- ☐ Substitution rejected - Use specified materials.
- ☐ Substitution Request received too late - Use specified materials.

Signed by: _____

Date: _____

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

SECTION 01 7419

WASTE MANAGEMENT

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Contractor requests that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Contractor may decide to pay for additional recycling, salvage, and/or reuse based on Landfill requirements.
- E. Salvage/Recycle Requirements: Salvage and recycle as much nonhazardous construction waste as possible. Include following:
- F. Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials.
 - 1. Paper.
 - 2. Cardboard.
 - 3. Boxes.
 - 4. Plastic sheet and film.
 - 5. Polystyrene packaging.
 - 6. Wood crates.
 - 7. Plastic pails.
- G. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: List of items to be salvaged from the existing building for relocation in project or for Owner.
- B. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- C. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- D. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- E. Section 01 7000 - Execution Requirements - Alteration Projects: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

- D. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- E. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- F. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- G. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- H. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- I. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- J. Return: To give back reusable items or unused products to vendors for credit.
- K. Reuse: To reuse a construction waste material in some manner on the project site.
- L. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- M. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.
- N. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- O. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- P. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- Q. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- R. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Waste Management Plan: Include the following information:
 - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 - 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
 - 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - a. List each material proposed to be salvaged, reused, or recycled.
 - b. List the local market for each material.
 - c. State the estimated net cost, versus landfill disposal.
 - 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
 - 5. Materials Handling Procedures: Describe the means by which materials to be diverted

- from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

1.05 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following.
 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 2. Review requirements for documenting quantities of each type of waste and its disposition.
 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 5. Review waste management requirements for each trade.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

- A. See Section 01 6000 - Product Requirements for substitution submission procedures.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 6000:
 1. Relative amount of waste produced, compared to specified product.
 2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
 3. Proposed disposal method for waste product.
 4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 01 7000 for trash/waste prevention procedures related to cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following.
 - 1. Total quantity of waste.
 - 2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 - 3. Total cost of disposal (with no waste management).
 - 4. Savings in hauling and tipping fees that are avoided.
 - 5. Handling and transportation costs. Include cost of collection containers for each type of waste.
 - 6. Net additional cost or net savings from waste management plan.

3.03 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Architect-Engineer. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- C. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- D. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- E. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Pre-bid meeting.
 - 2. Pre-construction meeting.
 - 3. Regular job-site meetings.
- F. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Section 01500 - Temporary Facilities and Controls, for controlling dust and dirt, environmental protection, and noise control.

- G. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. As a minimum, provide:
 - a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
 - b. Separate dumpsters for each category of recyclable.
 - c. Recycling bins at worker lunch area.
 - 2. Provide containers as required.
 - 3. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 - 4. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- H. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- I. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- J. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- K. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

3.04 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

END OF SECTION

SECTION 01 7800

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 7000 - Execution Requirements - Alteration Projects: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.02 SUBMITTALS

- A. Project Record Documents: Submit documents to Contractor prior to claim for Final Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Owner 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.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
- D. As-Built Drawings
 - 1. As-Built drawings shall be submitted with both formats, PDF and AUTOCAD. During the project, if requested, drawings shall be submitted in AUTOCAD format for interface design between building and process equipment.

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.

3.02 OPERATION AND MAINTENANCE DATA

- A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

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. 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. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
 - C. Include color coded wiring diagrams as installed.
 - D. 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.
 - E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - F. Provide servicing and lubrication schedule, and list of lubricants required.
 - G. Include manufacturer's printed operation and maintenance instructions.
 - H. Include sequence of operation by controls manufacturer.
 - I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - J. Provide control diagrams by controls manufacturer as installed.
 - K. Provide coordination drawings, with color coded piping diagrams as installed.
 - L. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
 - M. Include test and balancing reports.
 - N. Additional Requirements: As specified in individual product specification sections.

3.05 OPERATION AND MAINTENANCE MANUALS

- A. Prepare electronic and paper versions of manual as described below.
- B. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- C. Prepare data in the form of an instructional manual.
 - a. Maintenance instructions for equipment and systems.
 - b. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - c. Certificates.
- D. Information must also be provided in PDF format.

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 and PDF files of each 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 03 3000
CAST-IN-PLACE CONCRETE (SHORT FORM)

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 03 3110 - Structural Concrete - Foundations.
- B. Section 03 3500 - Concrete Finishing.

1.02 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Structural Concrete for Buildings; 2010 (Errata 2012).
- B. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary; 2011.
- C. ACI SP-66 - ACI Detailing Manual; 2004.
- D. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2012.
- F. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement; 2009b.
- G. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2011a.
- H. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.
- I. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- J. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2012.
- K. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2012.
- L. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.
- M. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders; 2010.

1.03 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop drawings.
 - a. Steel reinforcement.
 - 2. Design Data.
 - a. Concrete mixture design.
- C. For Information.
 - 1. Product Data.
 - a. Cement.
 - b. Admixtures.
 - 2. Design / Performance Data.
 - a. Materials used in concrete.
 - 3. Test Reports.
 - a. Materials used in concrete.
 - b. Strength test.
 - c. Laboratory reports.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Admixtures.
 - 1. Air-entraining, in accordance with ASTM C260 to produce concrete air content, 6 percent, plus or minus 1-1/2 percent for concrete exposed to freezing and thawing.
 - 2. Water reducing admixtures.
 - a. Admixtures; Low-Range Water Reducing (LRWR), Mid-Range Water Reducing (MRWR), or High-Range Water Reducing (superplasticizer) (HRWR).
 - b. In accordance with ASTM C494, Type A or F.
 - c. Use to increase workability (slump) where required for concrete placement.
 - d. Slump of concrete: Not more than listed for mix prior to addition of admixture, or 6 inches following addition of admixture.
 - e. Other admixtures, including fly ash, require written acceptance by Architect-Engineer.
- B. Aggregate, Fine and Coarse.
 - 1. Clean and well graded.
 - 2. In accordance with ASTM C33.
 - 3. Coarse aggregate: Size 57, Class 5S.
 - 4. Not containing materials that are deleteriously reactive with alkalis in cement.
- C. Grout.
 - 1. Euclid Chemical Company; NS Grout: www.euclidchemical.com.
 - 2. Five Star Products, Inc.; Five Star Grout: www.fivestarproducts.com.
 - 3. L & M Construction Chemicals, Inc.; Duragrout: www.lmcc.com.
 - 4. W.R. Meadows, Inc.; CG-86 Grout: www.wrmeadows.com.
- D. Portland Cement: In accordance with ASTM C150, Type I or Type II.
- E. Reinforcement: Deformed bars.
 - 1. Material: Billet steel in accordance with ASTM A615 or rail steel in accordance with ASTM A996.
 - 2. Yield Strength of Reinforcement: Not less than 60,000 psi.
 - 3. Detailing: In accordance with ACI SP-66.
- F. Water: In accordance with ASTM C1602.
- G. Welded Wire Reinforcement.
 - 1. In accordance with ASTM A185.
 - 2. Yield Strength: Not less than 65,000 psi.
 - 3. In flat sheets, with proper support against displacement.

2.02 CONCRETE MIXES

- A. In accordance with ACI 301 and ACI 318.
- B. Mix Requirements.
 - 1. For slabs on grade (Type FS).
 - a. Ultimate compressive strength at 28 days: Not less than 4000 psi.
 - b. Cementitious content: Not less than 550 pounds per cubic yard.
 - c. Water/cementitious ratio: Not more than 0.48.
 - d. Slump: Not more than 3 inches.
 - e. Modulus of rupture at 28 days: Not less than 550 pounds per square inch.
 - 2. For concrete not otherwise indicated (Type B).
 - a. Ultimate compressive strength at 28 days: Not less than 3000 psi.
 - b. Cementitious content: Not less than 520 pounds per cubic yard.
 - c. Water/cementitious ratio: Not more than 0.51.
 - d. Slump: Not more than 4 inches.

3. Controlled Low Strength Material (CLSM).
 - a. Fly ash: Class F.
 - b. Fine aggregate: Not less than 1500 pounds per cubic yard.
 - c. Ultimate compressive strength f'c at 28 days per ASTM D4832: Not less than 100 psi.
 - d. Cement content: Not less than 100 pounds per cubic yard.
 - e. Slump: 7 to 10 inches per ASTM C143.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Soil Preparation.
 1. Footings are designed to bear on firm soil with allowable bearing pressure of 2,500 psf.
 2. Obtain concurrence of Owner's Field Representative of exposed soil quality before placing concrete for footings.
 3. Granular slab fill.
 - a. Dense-grade aggregate.
 - b. 4 inch depth of compactible material meeting following requirements.
 - 1) Passing 1-1/2 inch sieve: 100 percent.
 - 2) Passing 1 inch sieve: 85 to 100 percent.
 - 3) Passing 1/2 inch sieve: 50 to 75 percent.
 - 4) Passing No. 8 sieve: 20 to 45 percent.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
 - c. Install vapor retarder over granular slab fill as specified in Section 03 3120.
 4. Where soil conditions require change in size, depth, or design of footings other than that in the Contract, an adjustment shall be made in accordance with extra work performed.
- B. Formwork.
 1. Construct of smooth surface form material, true, rigid, leakproof.
 2. Brace externally and diagonally and sufficiently strong to support dead weight of forms and liquid weight of concrete without displacement.
- C. Reinforcement.
 1. In accordance with ACI SP-66 and ACI 318.
 2. Maintain position during concrete placement.
- D. Placement of Concrete.
 1. Temperature of Concrete at Placement: Not less than 55 degrees F, and not more than 90 degrees F.
 2. Atmospheric Temperature at Placement: Not less than 40 degrees F.
 3. Temperature of Concrete for seven Days of Curing: Not less than 50 degrees F.
 4. Protect from injurious wind, sun, and temperature.
 5. Water cure for seven days.
- E. Anchor Rods.
 1. Receive and build in.
 2. Use templates to ensure accurate location.
 3. Remove and replace anchor rods more than 3/16 inch out of position.
 4. Remove nuts after anchor rod installation, grease threads, replace nuts, and protect from damage during construction progress.

END OF SECTION

SECTION 03 3110
STRUCTURAL CONCRETE - FOUNDATIONS

PART 1 GENERAL

1.01 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Section 13 3419 - Metal Building Systems, for anchor rods and leveling plates.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-In-Place Concrete.
- B. Section 03 3500 - Concrete Finishing.

1.03 REFERENCE STANDARDS

- A. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2011.
- B. U.S. Army Corps of Engineers CRD-C621 – Specification for Nonshrink Grouts; 1989.

1.04 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. Product Data.
 - a. Grout.
 - 2. Manufacturer's Instructions.
 - a. Installation recommendations.
 - 1) Grout.

1.05 QUALITY ASSURANCE

- A. If bearing or contact earth is frozen, do not install concrete.
- B. Obtain concurrence by Owner's Field Representative of exposed soil quality before placing concrete for footings.
- C. Where soil conditions require change in size, depth, or design of footings other than as indicated on drawings, make allowance in accordance with unit prices previously agreed upon.

1.06 WARRANTY

- A. See Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Grout, Nonferrous.
 - 1. Premix, nonshrinking, structural.
 - 2. In accordance with ASTM C1107 Grade A or B and CRD-C621.
 - 3. Acceptable products.
 - a. The Euclid Chemical Company; NS Grout: www.euclidchemical.com.
 - b. Five Star Products, Inc.; Five Star Grout: www.fivestarprouducts.com.
 - c. L & M Construction Chemicals, Inc.; Duragrout: www.lmcc.com.
 - d. W.R. Meadows, Inc.; CG-86 Grout: www.wrmeadows.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CONCRETE MIXES

- A. Concrete for Foundations: As specified in Section 03 3000.
- B. Concrete Exposed to Weathering: Entrained air 6 percent, plus or minus 1-1/2 percent.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Concrete Foundations.

1. Cast to size and shape indicated on drawings for allowable soil bearing pressure at bottom of foundations.
 2. Construct forms.
 - a. Footings encapsulated by undisturbed hardpan, may be cast without use of forms.
 - b. Form keyways, offsets, clearances, and recesses.
 3. Reinforcing steel.
 - a. Size, spacing, and placement as indicated in Contract Documents.
 - b. Before placing concrete in footings, block up 3 inches from ground and securely fasten in place.
 - c. Furnish and install templates for holding in place where necessary to ensure compliance with the Contract.
 4. Where supporting steel column, bring concrete to 2 inches below bottom of structural steel bearing plate, allow to set properly, and finish with grout and leveling plate as specified elsewhere in this section.
 5. Beveled slots.
 - a. Size: 3-1/2 inches by 1-1/2 inches deep unless otherwise indicated on Contract drawings.
 - b. Length: Continuous in top of footings to receive concrete walls.
- B. Dowels.
1. Furnish size and spacing indicated, and install where indicated on drawings.
 2. Furnish and install of size and at spacing indicated for particular element that will be extended or connected with work installed under separate Contract.
- C. Concrete Walls and Grade Beams.
1. Construct to size, thickness, depth and of detail indicated in Contract Documents.
 2. Reinforcing steel.
 - a. As indicated in Contract Documents.
 - b. Reinforce exposed surfaces with No. 4 bars at 12 inches on center in each direction unless otherwise indicated in Contract Documents.
 3. Form keyways, offsets, slots, and recesses in walls.
 4. Beveled slots.
 - a. Size: 3-1/2 inches by 1-1/2 inches deep, unless otherwise indicated on Contract drawings.
 5. Where enclosing excavated parts, braced until concrete floor is placed and set or when otherwise directed.
 6. Finish: See Section 03 3500 - Concrete Finishing.
 7. Pipe sleeves for mechanical and electrical work passing through concrete walls.
 - a. Furnished and installed under respective Mechanical or Electrical Work.
 - 1) Cooperate fully with these contractors for proper coordination with their work.
 8. Plane of weakness and construction joints.
 - a. Locations: As indicated in Contract Documents.
 - b. Construction joint spacing shall not exceed 50 feet on center.
- D. Anchor Rods (Bolts).
1. Receive anchor rods and anchor rod setting plan furnished under another section.
 2. Fabricate and install templates to ensure accurate location of anchor rods.
 3. Build-in anchor rods.
 4. Remove and replace anchor rods out of position more than 3/16 inch.
 5. After installation, remove nuts, grease threads, replace nuts, and protect from damage during construction progress.
- E. Cleaning for Setting of Metal Building.
1. Performed for duration of Contract.
 2. Remove earth, ice, snow, mud, and water accumulated at foundations which interfere with setting of grout, checking of anchor rods and base elevations by Metal Building Contractor, and connection of structural steel elements to their foundations.

3.02 PROTECTION

- A. Protect foundations under construction, and correct damage. Work at completion shall be in proper condition to receive succeeding work.
- B. Replace damaged or defective work.
- C. Correct other construction damaged during replacement of this work.
- D. Patched work is not acceptable.

END OF SECTION

SECTION 03 3120
STRUCTURAL CONCRETE - SLABS ON GROUND

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-In-Place Concrete.
- B. Section 03 3500 - Concrete Finishing.
- C. Section 31 2000 - Earth Moving.

1.02 REFERENCE STANDARDS

- A. ACI 302.1R - Guide for Concrete Floor and Slab Construction; 2004 (Errata 2007).
- B. ACI 360R - Guide to Design of Slabs-On-Ground; 2010.
- C. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- D. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2008).
- E. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements; 2012.
- F. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a.
- G. ASTM E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011.
- H. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

1.03 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop Drawings.
 - a. Floor joint layout indicating.
 - 1) Number of placements.
 - 2) Size of placements.
 - 3) Shapes of placements.
 - 4) Sequence of placements.
 - 5) Types of joints, construction or control.
- C. For Information.
 - 1. Product data.
 - a. Isolation joint filler.
 - b. Isolation joint sealant.
 - c. Epoxy joint filler.
 - d. Underslab vapor retarder.
 - 2. Test reports.
 - a. Vapor transmission of underslab vapor retarder.
 - 3. Field reports.
 - a. Slabs on Ground Placement Documentation Report.
 - b. Slabs on Ground Placement Sequence.
 - 4. Manufacturer's instructions.
 - a. Isolation joint filler installation.
 - b. Isolation joint sealant installation.
 - c. Epoxy joint filler installation.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

1.05 QUALITY ASSURANCE

- A. Placement Documentation Report.
 - 1. Prepare and execute for each placement of Structural Concrete - Slab on Ground on project.
 - 2. Include documentation for preplacement, placement, and post-placement.
 - 3. Obtain signatures of responsible parties.
 - 4. Use form appended.
 - 5. Submit completed documentation to Architect-Engineer for each placement for record.

1.06 WARRANTY

- A. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Isolation Joint Filler.
 - 1. In accordance with ASTM D1751.
 - 2. Acceptable products.
 - a. Flexcell Joint Filler by Owens Supply Company LLC, Plainfield, Illinois 60585: www.owensupply.com.
 - b. Fibre Expansion Joint by W.R. Meadows, Inc., Elgin, Illinois 60121: www.wrmeadows.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- B. Isolation Joint Sealant.
 - 1. Rubber and asphalt type.
 - 2. In accordance with ASTM D6690.
- C. Control/Construction Joint Epoxy Sealant.
 - 1. 2 component: 100 percent solids.
 - 2. Shore A hardness: 80 to 90.
 - 3. Shore D hardness: 50 to 55.
 - 4. Acceptable products.
 - a. MM-80 or MM-80-MOD by Metzger/McGuire Co., Concord, New Hampshire 03301.
 - b. Sikadur 51 SL by Sika Corporation, Lyndhurst, New Jersey 07071: www.sikaconstruction.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- D. Underslab Vapor Retarder.
 - 1. High density resin film. Single ply polyethylene is prohibited.
 - 2. In accordance with ASTM E1745, Class A .
 - 3. Vapor transmission rate as determined by ASTM E154: Not more than 0.01 perm.
 - 4. Provide manufacturer accessories: tape, boots, mastic, etc. to seal penetrations, joint laps, punctures, and tears for complete vapor retarder installation.
 - 5. Acceptable products.
 - a. Moistop Ultra 15, 15 mil by Fortifiber Corporation, Reno, Nevada 89509: www.fortifiber.com.
 - b. Perminator 15, 15 mil by W.R. Meadows, Hampshire, Illinois 60140: www.wrmeadows.com.
 - c. VaporBlock 15 by Raven Industries, Sioux Falls, South Dakota 57117: www.ravenind.com.
 - d. Viper Vapor Check II 15 mil by Insulation Solutions, East Peoria, Illinois 61611: www.insulationsolutions.com
 - e. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Concrete Slabs On Ground.
 - 1. Subgrade shall be brought to correct level as part of work specified in Section 31 2000.
 - 2. Perform additional filling, fine grading and compacting of subgrade under concrete floors under this heading to true line and grade using same procedures and following requirements as specified in Section 31 2000.
 - 3. Properly embed and finish up to steel frames, nosings, and bolts specified in different Sections.
 - 4. Do not lay concrete floors until piping, conduits, and related items, furnished by other contractors and installed into or under slabs on ground, are in place.
 - 5. Underslab vapor retarder.
 - a. Installation in accordance with ASTM E1643.
 - b. Apply in widest widths practical with longest dimension parallel with direction of concrete slab placement.
 - c. Lap side and end joints not less than 6 inches, seal joints with continuous tape furnished by membrane manufacturer.
 - d. Closely fit membrane around penetrations.
 - e. Use manufacturer's boot or mastic to form collar at penetrations.
 - f. Repair punctures and tears with tape prior to granular fill and concrete placement.
- B. Finish surfaces of concrete slabs: Specified in Section 03 3500.
- C. Tolerances for floor surfaces: Specified in Section 03 3500.
- D. Monolithic Slab Placement Limitations.
 - 1. Pour in strip pattern.
 - 2. Area commensurate with available equipment and personnel.
 - 3. Submit with bid, anticipated maximum single placement area and single placement length.
- E. Joints in Floors.
 - 1. Fabricate joints in accordance with joint patterns indicated on drawings.
 - 2. Isolation.
 - a. Fabricate isolation joints at each column penetration.
 - b. Install isolation joint filler in accordance with manufacturer's recommendations.
 - c. Seal with isolation joint sealant.
 - 3. Control.
 - a. Install in uniform spacing within each bay at 15 feet or less on centers, unless otherwise shown.
 - b. Saw cut joints in floors.
 - 1) Saw cut prior to time initial shrinkage cracks would develop, but not more than 8 hours after placement.
 - 2) Use early entry dry-cut method with high speed diamond blade or use diamond blade wet cut method.
 - 3) Saw cut groove shall be dimension designated on drawings.
 - 4) Do not permit water supply truck associated with wet cut method on floor.
 - 5) Completely remove concrete and slurry resulting from sawing operation from groove and concrete surface.
 - 6) Repair raveling or spalling along joint.
 - (a) Repair minor spalled areas by sawing a wider groove or by using epoxy concrete.
 - (b) Repair major spalled areas using methods and materials accepted by Architect-Engineer.
 - 7) Spalled areas will be classified as minor or major by Owner or Architect-Engineer.

- 8) Temporarily seal joint groove with suitable material or device to prevent infiltration of foreign material until sealing compound is installed.
 - 9) Do not permit traffic over joint groove until permanent sealing compound or temporary seal is installed.
- c. Fill joints with epoxy joint filler.
- 1) Not sooner than 90 days after final finishing.
 - 2) Apply in accordance with manufacturer's recommendations.
 - 3) Remove debris from joint using round steel brush on a drill or hook-ended raking tool.
 - 4) Vacuum joint, do not use compressed air.
 - 5) To prevent filler from running through shrinkage cracks in control joints, fill shrinkage crack and not more than 1/4 inch of control joint with silica sand or semi-rigid, star shaped PVC rod with shore hardness A-90.
 - 6) To establish 2 inch minimum depth of filler in construction joints: Fill with silica sand or semi-rigid, star shaped PVC rod with shore hardness A-90.
 - 7) Install in 2 lifts, second lift while first is still tacky.
 - 8) Finish flush or slightly convex.

STRUCTURAL CONCRETE - SLABS ON GROUND
PLACEMENT DOCUMENTATION REPORT

Job No:

Project:

Prepare and execute pre-placement, placement, and post-placement documentation for each section of concrete slab on ground required for the project. Include the following.

SLAB SECTION

Location: _____

Date: _____

Mix: _____

PRE-PLACEMENT

☐ Area protected from rain, snow, and wind.

☐ Subgrade preparation / proof rolled

☐ Underslab vapor retarder (if required)

Sub Base preparation

☐ Correct granular fill used

☐ Underground utilities installed

☐ Floor drains set to correct elevation

Reinforcing steel

☐ In correct position

☐ Properly tied

Formwork

☐ Set in proper position

☐ Free from defects

Plate dowels

☐ Properly placed

Thickness of slab

☐ Minimum throughout placement area

Present

☐ Required tools

☐ Required equipment

☐ Personnel

PLACEMENT

☐ Air handling equipment: Air flow directed away from slab.

☐ Subbase: Slightly dampened.

Concrete deliveries.

☐ Meets requirements for slump

☐ Did not exceed maximum time limits.

☐ Diagonal bars: Placed at reentrant corners.

PLACEMENT, continued

- ☐ Screeding: Using techniques agreed to in preinstallation meeting.
- ☐ Vibrating: Concrete along edge forms.
- ☐ Dry shake (if required): Placed in accordance with manufacturer's written instructions.
- ☐ Bleed water: Excess has been removed prior to start of floating operations.
- ☐ Final troweling: In accordance with specifications.

POST-PLACEMENT

- ☐ Curing operations: Started not more than 10 minutes after final troweling.
 - ☐ Slab: Wetted prior to placing curing sheets.
 - ☐ Curing sheets: Placed with lapped joints at locations of saw cuts.
- Saw cuts.
- ☐ Early entry dry-cut.
 - ☐ Diamond blade wet cut.
- Made hours after final troweling.

SIGNATURES

Slab on Ground Contractor:
Mechanical Contractor:
Electrical Contractor:
Architect-Engineer:

After each pour, submit completed documentation to Architect-Engineer for record.

END OF SECTION

SECTION 03 3500
CONCRETE FINISHING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-In-Place Concrete.
- B. Section 03 3110 - Structural Concrete - Foundations.
- C. Section 03 3120 - Structural Concrete - Slabs on Ground.

1.02 REFERENCE STANDARDS

- A. ASTM E1155M - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers (Metric); 1996 (Reapproved 2008).

1.03 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.

1.04 QUALITY ASSURANCE

- A. Quality assurance provisions in Section 03 3000 govern.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

1.06 WARRANTY

- A. See Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MATERIALS

PART 3 EXECUTION

3.01 INSTALLATION

- A. Horizontal Surfaces, Tolerances.
 - 1. Finish to levels and specified tolerances.
 - 2. Slope floor surfaces to floor drains and trenches.
 - 3. Do not dust with dry materials or add water to surfaces being finished.
- B. Floor Flatness and Levelness Tolerances.
 - 1. In accordance with ASTM E1155.
 - 2. Face floor flatness number.
 - a. Ff number specified under, CFH-, is Specified Overall Value (SOV).
 - b. Minimum local value (MLV) shall be as follows.
 - 1) For CFH-D, Ff 25 and MLV equals Ff 17.
 - 3. Face floor levelness number.
 - a. FI number specified under, CFH-, is Specified Overall Value (SOV).
 - b. Minimum local value (MLV) shall be as follows.
 - 1) For CFH-D, FI 17 and MLV equals FI 11.
 - 4. Are multidirectional and measured for distances up to 120 inches anywhere on floor.
 - 5. Design elevation shall be reference for measurements.
 - 6. Levelness tolerances do not apply to inclined floor surfaces and floors placed on unshored formed surfaces.
 - 7. Specified overall Ff/FI values are minimum values obtained for combined individual floor sections.
 - 8. Minimum local values Ff/FI are absolute minimum surface profile acceptable in each floor section.
 - 9. Floor section is defined as smaller of following two areas.

- a. Area bounded by building column lines or half bay lines (area equal to 1/4 area bounded by building column lines).
 - b. Area bounded by slab construction joints or control joints.
- 10. Owner will verify Ff/FI numbers.
- 11. Contractor may conduct and pay for separate tests.
- 12. Special precautions required.
 - a. Forms shall be properly leveled, in good condition, and solidly anchored, including special attention to ends and transitions.
 - b. Keep bearing surfaces for straightedges, forms, and previously poured slabs clean of laitance, sand, gravel, or other roughness.
 - c. Give special attention to flatness at edge of slabs adjacent to future pours.
 - d. Keep screeds in good condition with true round rolling wheels and level cutting edges.
 - e. Use optical sighting equipment (lasers) for checking level and straightness.
 - f. Promptly adjust equipment when test results indicate possibility of deviation.
- 13. Use highway scraping straightedges instead of bull floats for slab placement and finishing operations.
- 14. Acceptance.
 - a. Remove and repour floor sections measuring below minimum local value Ff or FI number.
 - b. Extension of scheduled completion dates will not be granted.
 - c. Make repoured section boundaries coincide with column or joint lines which define floor section.
 - d. Repoured sections will be tested for compliance.
 - e. Remove sections requiring repouring by saw cutting along section boundary lines with a neat clean joint between repoured slab and existing slab.
 - f. Reinforce repoured slab the same as removed section.
 - g. Dowel into existing slab at joints with dowels and spacing shown on drawings for construction joints.
 - h. Floor sections measuring at or above minimum local value Ff and FI numbers will be accepted by Owner and Architect-Engineer if actual combined Ff and actual combined FI values for entire floor meet or exceed specified overall values of Ff and FI.
- C. Construction Joint or Control Joint Differential Tolerance.
 - 1. Elevation differential across joints: Not greater than 1/8 inch.
 - 2. Make and record differential elevation measurements and report to Owner and Architect-Engineer.
 - a. Make first measurement within two weeks of curing process completion.
 - b. Make second measurement three months after last slab is placed.
 - 3. Remediate joints with differential elevations greater than acceptable tolerance by grinding, grouting, slab replacement, or other approved means to satisfaction of Owner.
- D. Horizontal Surface Finishes, General.
 - 1. Concrete finishing of horizontal floor and nonfloor surfaces is subdivided into classifications entitled, CFH-.
 - 2. Documents establish location of each classification.
 - 3. If discrepancy occurs for finish classification, drawings take precedence over Specifications.
- E. Finish CFH-A.
 - 1. Process.
 - a. Screed surfaces.
 - 2. Locations.
 - a. Top of foundations.
- F. Finish CFH-C.

1. Process.
 - a. Screed, float, and finish with minimum single pass of steel trowel.
 2. Locations.
 - a. Slabs to receive thin-setting materials.
- G. Finish CFH-D.
1. Process.
 - a. Screed, float, and finish with minimum two passes of steel trowel to create smooth, hard, dense surface free from shrinkage cracks.
 - b. Tolerance: 1/4 inch in 10 feet.
 - c. Tolerance: Ff 25 / FI 17.
 - d. Restraighten concrete to achieve floor tolerances.
 2. Locations.
 - a. Exposed floors.
 - b. Horizontal surface finishes, not otherwise shown on drawings or specified.
- H. Finish CFH-K.
1. Process.
 - a. Screed, float, trowel, and then broom to produce nonslip finish.
 - b. Texture subject to approval of Architect-Engineer.
 2. Locations.
 - a. Loading docks.
 - b. Slabs in wet areas.
- I. Curing, Horizontal Surfaces.
1. Comply with provisions in Section 03 3000.
 2. Use curing sheet material with joints taped or water saturated polyethylene/burlap.
 3. Seal joints and prevent blowoff.
- J. Vertical Finishes, General.
1. Remove forms as soon as possible after concrete placement.
 2. Finishing and dressing applied to a formed vertical concrete surface is classified as CFV-.
 3. Documents establish locations of each classification.
 4. If discrepancy occurs for finish classification, drawings take precedence over Specifications.
- K. Finish CFV-D.
1. Process.
 - a. Roughness is objectionable on surfaces subject to public view.
 - b. Build forms without visible offsets or bulges.
 - c. Form panel sizes shall be uniform.
 - d. Uniformly space tie holes.
 - e. Exercise special care at construction joints.
 - f. Sack rub or grout clean surfaces to obtain uniform color and texture using materials from same source.
 2. Locations.
 - a. Exposed-to-view vertical surfaces.
 - b. Exposed concrete, including top surfaces of grade beams, loading docks, and similar surfaces.

3.02 FIELD QUALITY CONTROL

- A. Testing and Acceptance of Flatness and Levelness Tolerances.
1. In accordance with provisions and procedures of ASTM E1155.
 2. Floor tolerance measurements, made within 48 hours after completion of each slab pour.
 3. Tolerance measurements, precede removal of shores and forms.
 4. Test sample measurement lines, not made within 2 feet of test section boundary, construction joint, floor penetration or other discontinuity.

5. Results of floor profile tests, distributed within 72 hours after each slab pour.

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Furnish listed components for installation under Section.
 - 1. 03 3000 – Cast-In Place Concrete.
 - a. Pipe guard posts to be set in concrete foundations.
 - b. Miscellaneous iron (steel) components.

1.03 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

1.04 REFERENCE STANDARDS

- A. AGA - MA-11, Recommended Details for Galvanized Structures, August 1990.
- B. AISC (COMM) - Commentary on the Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design; 1999.
- C. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; 2005.
- D. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2002.
- E. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2005.
- F. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2006a.
- G. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.
- H. ASTM A 283/A 283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2003.
- I. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2006.
- J. ASTM A 325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2005.
- K. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2003a.
- L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2007.
- M. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2006.
- N. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).
- O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).
- P. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

- B. For Review.
 - 1. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - a. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - b. Metal (miscellaneous iron) fabrications.
 - 1) Supports for metal siding.
 - 2) Pit Ladder rungs
 - 3) Steel nosings and ledge supports.
 - 4) Miscellaneous iron (steel) components.
- C. For Information.
 - 1. Product data.
 - a. Manufactured steel items.
 - b. Epoxy anchors.
 - 2. Certificates.
 - a. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.06 QUALITY ASSURANCE

- A. Unless otherwise specified or superseded by local building or state codes, detail, fabricate, and erect metal fabrications in accordance with AISC Specification, Code, and Detailing Manual.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Lightest standard section rolled for each shape to fabricate components, unless details designate weight, then use that weight.
- B. Shapes: ASTM A 36/A 36M
- C. Tubing: ASTM A 500, Grade B cold-formed structural tubing.
- D. Plates: ASTM A 283.
- E. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.
- F. Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, galvanized to ASTM A 153/A 153M where connecting galvanized components.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- I. Shop Prime Paint.
 - 1. Free of heavy metal compounds (lead and chromate).
 - 2. Vehicle, solvent based with sufficient water solubility and reactivity with metal substrate, and soluble enough for sufficient ions to react with and passivate metal surface.
 - 3. Acceptable products.
 - a. Devguard 4160 (gray) by ICI/Devoe Coatings; www.devoecoatings.com.
 - b. Interlac 573 (gray) or Interprime 298 (gray) by International Protective Coatings; www.international-pc.com.
 - c. Series 10 Primers (gray) by Tnemec Company, Inc.; www.tnemec.com.
 - 4. Effective to protect steel against atmospheric corrosion during storage (at fabricator's shop, in a warehouse, and at jobsite), during transit, and while in place at building site, until steel units are protected from weather by building enclosure, for minimum of 4 months exposure after erection.

5. Film thickness on steel surfaces equal to or greater than wet or dry film thickness required by paint manufacturer's literature or as required by above criteria.
- J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MANUFACTURED UNITS

- A. Machine Bolts.
 1. In accordance with ASTM A 307 with hexagonal head complete with washer and hexagonal head nut and zinc coated (galvanized) in accordance with ASTM A 153 where connecting zinc coated components.
 2. Diameter: 3/4 inch, unless otherwise indicated on Contract drawings.
 3. For Ladders: Not less than 1/2 inch diameter hex head complete with washer and hex head nut.
 4. Length: Not more than 1/4 inch beyond nut.
- B. Expansion Anchors.
 1. Characteristics.
 - a. Shank length and diameter to obtain proper holding strength for load applied and for substrate type as recommended by anchor manufacturer.
 2. Acceptable products.
 - a. Ackerman-Johnson Fastening Systems, Inc.; (800) 543-2797.
 - b. Hilti, Inc.; www.us.hilti.com.
 - c. Trubolt Wedge Anchor by ITW Ramset/Red Head, Wood Dale, Illinois 60191
www.ramset-redhead.com.
 - d. Power-Bolt by Powers Fasteners, Inc., New Rochelle, New York 10801
www.powers.com.
 - e. Ankr-tite Stud Anchor by Wej-It Fastening Systems, Tulsa, Oklahoma 74104
www.wejit.com.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
- C. Epoxy Anchors.
 1. Characteristics.
 - a. 2-part epoxy system consisting of base resin, hardener, and aggregate.
 2. Acceptable products.
 - a. Anchor-It Fastening Systems by U.S. Anchor Corp., Pompano Beach, Florida 33064
www.usanchor.com.
 - b. Epcon System by ITW Ramset/Red Head, Wood Dale, Illinois 60191
www.ramset-redhead.com.
 - c. HIT RE 500 System by Hilti, Inc., Tulsa, Oklahoma 74146 www.hilti.com.
 - d. Power-Fast Epoxy Injection Gel System by Powers Fasteners, Inc., New Rochelle, New York 10801 www.powers.com.
 - e. SET High Strength Epoxy by Simpson Strong-Tie Co., Inc., Columbus, Ohio 43228
www.simpsonanchors.com.
 - f. Substitutions: See Section 01 6000 - Product Requirements.

2.03 FABRICATION

- A. Members without twists, bends, open joints, misalignment, ragged edges.
- B. Miters and joints accurately cut and fit.
- C. Members true to length for assembly without fillers.
- D. Exposed surfaces free of mill scale, rust, pits, craters, burrs, and other irregularities.
- E. Completed assembly strong, rigid, and neat in appearance.
- F. Bevel splice plates at a change in width of adjacent members.

- G. Fabrication and erection tolerances associated with structural steel are considered excessive and will not be accepted.
- H. Fit and shop assemble items in largest practical sections, for delivery to site.
- I. Fabricate items with joints tightly fitted and secured.
- J. 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.
- K. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- L. Shop Connections.
 - 1. Welded or bolted, unless otherwise indicated on drawings.
 - 2. In accordance with the following criteria.
 - 3. Welding.
 - a. Steel in accordance with AWS D1.1.
 - b. Shop weld by shielded metal arc, gas metal arc with carbon dioxide shielding, submerged arc welding, flux cored arc welding process.
 - c. Use shielded arc electrodes not over 3/16 inch diameter.
 - d. Use properly qualified operators skilled in making strong, neat welds with this electrode.
 - e. Join parts in as close contact as possible with size of weld increased by amount of separation if separation exceeds 1/16 inch.
 - f. Remove loose slag, scale, rust, grease, paint, other foreign material to expose clean steel surfaces for welding.
 - g. Weld shall be sufficient size and length to develop required stresses with minimum size of weld to transmit stresses of 3/16 inch.
 - h. Continuous and watertight at exterior members.
 - i. Grind smooth with surfaces of members where exposed.
 - j. Stainless steel: Grind, brush, and polish to match adjacent factory finish.
 - k. If welding is not applicable, use bolts.
 - l. Where design calls for welding of 2 elements of different thickness and where these thicknesses are incompatible for proper welding, properly connect angles or plates of proper thickness ratio.
 - m. Use necessary jigs and clamps to prevent distortion during welding.
 - n. Employ procedures to prevent undercutting, insufficient throat or leg, lack of fusion, spattering.
 - o. Bring parts to be fillet welded in as close contact as practicable.
 - p. Size of fillet weld shall be such that stresses in adjacent base material do not exceed allowable value for this material.
 - 4. Bolting.
 - a. Accurately space holes for bolts using diameter 1/16 inch greater than nominal diameter of bolt.
 - b. Drill material having thickness in excess of bolt diameter, plus or minus 1/8 inch, and material 7/8 inch thick or greater.
 - c. Use not less than 2 bolts at each component connection.
 - d. Space bolts at not more than 2 feet on centers, unless otherwise indicated on drawings.
 - e. Use bolts that project not more than 1/4 inch beyond face of nut.
 - f. Use 3/4 inch diameter machine bolts, unless otherwise indicated on drawings.

2.04 FABRICATED ITEMS

- A. Steel Nosings and Ledge Supports.
 - 1. Fabricate from angles, channels, and shapes indicated on drawings.
 - 2. Form returns with neat mitered joints, weld, grind smooth, and brace where required.

3. Form joints with 6 inch long splice plate back of joint and drill for bolt connections to result in tight joints in perfect alignment.
 4. Weld on anchors of size, shape, and spacing indicated on drawings.
 5. Space anchors 24 inches on center maximum, unless otherwise shown.
 6. Prepare nosing / ledge supports and weld flush to top of angle.
 7. Grind smooth.
- B. Miscellaneous Iron (Steel) Components.
1. Furnish and install other items of steel.
 - a. Which are shown on drawings including press and other production machinery drawings but not specifically mentioned.
 - b. Not furnished in other Sections of Specification.
 2. Zinc coated at exterior locations.
 3. Prime painted at interior locations.

2.05 FINISHES - STEEL

- A. Prime paint all steel items.
- 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.
1. Clean in accordance with SSPC-SP 6.
 2. Apply 1 coat of shop prime paint before leaving shop.
 3. Apply 2 coats of shop prime paint before assembling on surfaces that will be inaccessible for painting after assembling.
 4. Apply paint with smooth and even surfaces suitable to receive field coat of paint.

2.06 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. Take measurements at site and not from scale drawings.
- B. Inspect site and become familiar with conditions before starting installation.
- C. Make careful study of drawings and become familiar with work constructed by other before and during erection of this work.
- D. Make allowances in method of erection and distribution of materials before and during erection for obstructions which may be encountered resulting from work of others.
- E. Verify that field conditions are acceptable and are ready to receive work.

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. Join components together with tight, even joints for good appearance.
- C. Anchor and secure components if not listed under heading, Products Furnished But Not Installed Under This Section.
- D. Furnish and install lugs, connections, bearing plates, anchors, and bolts required for erection.
- E. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- F. Drill holes for connecting components.
 - 1. Before penetrating structural members, obtain acceptance from Engineer.
- G. Field weld components unless otherwise indicated on drawings.
- H. Perform field welding in accordance with AWS D1.1/D1.1M.
- I. Anchorage of Components to Concrete.
 - 1. Use embedded strap anchors.
- J. Anchorage of components to structural steel.
 - 1. Do not weld to structural framing members.
 - 2. Design connections in accordance with AISC Specification.
 - 3. Use high strength bolts for field connections with tensile and shear forces.
 - 4. Machine bolts may be used for other field connections.
 - a. Bolts shall have hex head nuts, pipe sleeves, nuts, and rubberized washers at connections through metal siding.
- K. Powder-actuated anchors will not be approved.
- L. Obtain approval prior to site cutting or making adjustments not scheduled.
- M. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.
 - 1. Prepare surfaces in accordance with SSPC SP 3.
 - 2. After erection, bolts, nuts, welds, and unpainted areas with 1 coat of same paint as shop coat.
 - 3. Areas of paint damaged during shipping and erection with 1 coat of same paint as shop coat.

3.04 ERECTION 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 05 5100

METAL STAIRS

PART 1 GENERAL

1.01 REFERENCES

- A. AISC (COMM) - Commentary on the Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design; 1989.
- B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; 2005.
- C. AISI SG03-2 - Cold-Formed Steel Design Manual; 2002.
- D. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2005.
- E. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.
- F. ASTM A 143/A 143M - Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement; 2007.
- G. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.
- H. ASTM A 283/A 283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2003.
- I. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2006.
- J. ASTM A 384 - Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies; 2007.
- K. ASTM A 563 - Standard Specification for Carbon and Alloy Steel Nuts; 2004a.
- L. ASTM A 1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability; 2006b.
- M. ASTM B 6 - Specification for Zinc; 2007.

1.02 SYSTEM DESCRIPTION

- A. Design and construct components of structural steel shapes, bars, and plates in accordance with AISC Specification and Code.
- B. Construct exposed steel in accordance with AISC Specification, Section 10 for architecturally exposed structural steel.
- C. Construct components of 3/16 inch or less thickness steel in accordance with AISI Design Manual.
- D. Weld in accordance with AWS Code.
- E. Design stairs for live load of 100 psf with maximum deflection ratio of.
 - 1. 1/180 for open riser grating stairs.
- F. Take measurements for work at jobsite.
- G. Fit work, as far as possible, together in shop.
- H. Deliver complete, ready to erect.

1.03 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop drawings.
 - a. Metal stairs with grating treads and platforms.

1.04 DELIVERY, STORAGE, AND PROTECTION

- A. See Section 01 6000 – Product Requirements, for transportation, handling, storage. and protection requirements.

1.05 WARRANTY

- A. See Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Hot-Rolled Structural Steel Shapes.
 - 1. In accordance with ASTM A 36.
 - 2. Where weights of steel sections are not given, lightest standard sections rolled.
- B. Bolts and Nuts: Hexagonal, 3/4 inch size, ASTM A 325, unless otherwise noted.
- C. Checkered Plate.
 - 1. Hot-rolled steel plate.
 - 2. In accordance with ASTM A 283, Grade C with four-way checkered pattern.
 - 3. Free of mill scale.
 - 4. Thickness: Not less than 1/4 inch.
- D. Zinc.
 - 1. For hot-dip galvanizing.
 - 2. In accordance with ASTM B 6.
- E. Zinc Paint for Touch-Up of Zinc Coatings.
 - 1. Zinc Clad 5: Sherwin-Williams.
 - 2. Tneme-Zinc 90-97: Tnemec.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- F. Expansive Anchors.
 - 1. Ackerman-Johnson Expansive Screw Anchors; (800) 543-2797.
 - 2. Powers Fasteners Calk-In: www.powers.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURED UNITS

- A. Grating Treads and Platforms.
 - 1. Alabama Metal Industries Corp.: www.amico-grating.com.
 - 2. IKG Industries: www.ikgindustries.com.
 - 3. Ohio Grating: www.ohiograting.com
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Shop Prime Paint.
 - 1. Characteristics.
 - a. Free of heavy metal compounds (lead and chromate).
 - b. Film thickness, equal to or greater than recommended by paint manufacturer's literature.

2. Acceptable products.
 - a. Devguard 4160 (gray) by ICI/Devoe Coatings: www.devoecoatings.com.
 - b. Interlac 573 (gray) or Interprime 298 (gray) by International Protective Coatings: www.international-pc.com.
 - c. Series 10 Primers (gray) by Tnemec Company, Inc.: www.tnemec.com.
 - d. Substitutions: See Section 01600 - Product Requirements.

2.03 FABRICATION

- A. Grating Tread Stairs.
 1. Construct with stringers of size, shape shown, grating treads, and landing supported on steel angle supports or by carrier plates, securely welded.
 2. Gratings.
 - a. Fabrication: Pressure locked or welded.
 - b. Bearing Bar Size: 1-1/2 inches by 3/16 inch.
 - c. Bearing Bar Spacing: 1-3/16 inches on center.
 - d. Cross Bar Spacing: 4 inches on center.
 3. Cast abrasive nosings.
 - a. Located on treads and edges of landings and platforms.
 - b. Supported on steel angle, both full width between stringers.
 - c. Support angle welded at ends to stringers and at intermediate points to grating tread, landing or platform.
 - d. Welds at grating spaced not more than 12 inches on center.
 - e. Top of nosing flush with top surface of grating.
- B. General.
 1. Finished members shall be free from twists, bends, or open joints.
 2. Fabricate true to details and shop drawings.
 3. Members shall be of proper length without fillers.
 4. Use beveled splice plates at change of thickness.
 5. Cope, block or miter to form neat joints.
 6. Accurately cut and fit miters and joints.
 7. Grind exposed welds smooth and remove burrs.
 8. Welds exposed to weather shall be continuous, watertight, and ground smooth.
 9. Burning in shop will not be accepted.
 10. Where exposed, use hexagonal bolts of correct length allowing no more than 1/4 inch exposed beyond nuts.
 11. Connect members with at least two bolts or equivalent welds.
 12. Punch holes for connection of members. Request information for holes required.
Contractors will drill needed holes if Contractor fails to give required information on time.
- C. Welding.
 1. Use shielded arc electrodes not over 3/16 inch diameter.
 2. Make fillets larger than 5/16 inch in not less than two passes.
 3. Strength and good appearance are essential.
- D. Furnish lugs, connections, bearing plates, and bolts required for erection.
- E. Corrosion Protection.
 1. Thoroughly clean and apply one coat of shop prime paint to exposed areas and two coats of paint to areas inaccessible for painting after erection.
 2. Painted surfaces shall be smooth, even, and suitable to receive field coat of paint.
 3. Cover to protect steel against atmospheric corrosion during storage, during transit, and while in place at building site until steel units are protected from weather by building enclosure.
 4. Film Thickness: Not less than required by paint manufacturer's literature.
 5. Metal Stair: Hot dip, zinc coated.
 6. Apply zinc coating to components of stair, including fasteners, in accordance with ASTM A 123.

- F. Safeguard against steel embrittlement in accordance with ASTM A 143.
- G. Safeguard against warpage and distortion of steel members in accordance with ASTM A 384. H. Weight, finish, and uniformity of zinc coating and adhesion of coating in accordance with ASTM A 123.
- I. Bolts, Nuts, Washers, and Other Hardware.
 - 1. Apply hot-dip zinc coating in accordance with ASTM A 123.
- 2. Weight of coating in accordance with ASTM A 153.
 - 3. Retap nuts after galvanizing to minimum diametral amounts in accordance with ASTM A 563, coat with waterproof lubricant, clean and dry to touch.
 - 4. High strength bolts for structural steel joints: Zinc coated in accordance with ASTM A 325.
- J. Factory Touch-Up of Damaged Zinc Coatings.
 - 1. Sprayed zinc.
 - a. Clean and preheat to ensure freedom from loose material, moisture, oil, grease, or other foreign matter before applying zinc.
 - b. Apply zinc by metallizing spray process to clean and dry surfaces.
- K. Zinc-Based Solders and Wires.
 - 1. Clean to remove loose material and contaminates.
 - 2. Heat to 572 degrees F.
 - 3. Apply zinc-alloy repair compound by spreading material over heated surface in accordance with manufacturer's instructions.
 - 4. Remove repair compound residue with damp cloth or by rinsing with water.
- L. Dry film thickness of applied repair materials: Not less than galvanized thickness in accordance with ASTM A 123 or A 153.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General.
 - 1. Anchor and secure work to adjacent masonry, concrete, and steel.
 - 2. Use embedded anchors or expansive anchors for masonry and concrete.
 - 3. Weld or bolt to steel.
 - 4. Before punching necessary holes for penetrating structural steel, obtain acceptance of Engineer's Field Representative.
 - 5. If members do not fit properly during erection, drill additional holes or cut material where necessary.
 - 6. Burning in field will not be accepted.
 - 7. Weld or bolt field connections as best suited for construction and accepted by Engineer's Field Representative.
 - 8. Weld in accordance with welding paragraph under heading, Fabrication.
 - 9. Field paint after erection, bolts, nuts, welds, unpainted or damaged areas with one coat of shop prime paint.
 - 10. Repair zinc coating in field by painting fasteners and damaged surfaces with one coat of zinc paint.

END OF SECTION

SECTION 05 5213

PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 REFERENCES

- A. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2005.
- B. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2005.
- C. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.
- D. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength; 2004.
- E. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).
- F. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; current edition; (ADAAG - Americans with Disabilities Act, Accessibility Guidelines).

1.02 SYSTEM DESCRIPTION

- A. Design and construct railings and guards to support a concentrated load of 200 pounds applied at any point and in any direction along top and a uniform load of 50 pounds per foot along top applied in any direction.
- B. Design handrails and guardrails in accordance with ADAAG.

1.03 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop drawings.
 - a. Handrails and railings.
- C. For Information.
 - 1. Product data.
 - a. Mechanical connections.
 - b. Wall brackets and connectors.
 - c. Flange connections.
 - 2. Certificates.
 - a. OSHA Standards.

1.04 DELIVERY, STORAGE, AND PROTECTION

- A. See Section 01 6000 – Product Requirements, for transportation, handling, storage, and protection requirements.
- B. Handle components to protect finished surfaces.

1.05 WARRANTY

- A. See Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pipe for Steel Handrails and Railings.
 - 1. In accordance with ASTM A 53, Type E or F.

2. With longitudinal seam installed on underside.
 3. Nominal 1-1/2 inch inside diameter.
 4. For Posts: Extra strong weight, 0.200 inch wall thickness.
 5. For Railings, Handrails, and Similar Components: Standard weight, 0.145 inch wall thickness.
 6. Smooth and free of scale.
- B. Angles, Bars, Rods, and Similar Shapes for Steel Handrails and Railings.
1. In accordance with ASTM A 36.
 2. Use lightest standard section rolled for each shape to fabricate components, unless drawing details designate weights or dimensions.
 3. Smooth and free of scale.
- C. Parallel pipes as indicated on drawings.
- D. Shop Prime Paint.
1. Characteristics.
 - a. Free of heavy metal compounds (lead and chromate).
 - b. Film thickness equal to or greater than recommended by paint manufacturer's literature.
 2. Acceptable products.
 - a. Devguard 4160 (gray) by ICI/Devoe Coatings: www.devoecoatings.com.
 - b. Interlac 573 (gray) or Interprime 298 (gray) by International Protective Coatings: www.international-pc.com.
 - c. Series 10 Primers (gray) by Tnemec Company, Inc.: www.tnemec.com.

2.02 MANUFACTURED UNITS

- A. Machine Bolts.
1. Minimum 1/2 inch diameter, hex head, complete with washer and hex head nut.
 2. Length not more than 1/4 inch beyond nut.
 3. Steel in compliance with ASTM A 307 in connection with steel railings.
- B. Bolts shall be shank length and diameter to obtain holding strength for load applied and for substrate.

2.03 FABRICATION

- A. Members shall be without twists, bends, open joints, misalignment, or ragged edges.
- B. Miters and joints shall be accurately cut and fit. Members shall be true to length for assembly without fillers.
- C. Exposed surfaces shall be free of mill scale, rust, pits, craters, and similar irregularities.
- D. Completed assembly shall be strong, rigid, and neat in appearance.
- E. Welding.
1. Comply with AWS D1.1 for steel.
 2. Employ qualified operators skilled in making strong, neat welds.
 3. Join parts as close as possible.
 4. Remove loose slag, scale, rust, grease, paint, and foreign material to expose clean surfaces for welding.
 5. Sufficient size and length to develop required stresses.
 6. Continuous and watertight at exterior members.
 7. Ground smooth with surfaces of welded members and burrs removed.
- F. Mechanical Fasteners.
1. Metal compatible with pipe material.
 2. Assembly of anchor bars, threaded fasteners, and related components to develop tight, rigid connections.
 3. Concealed fasteners.

- G. Railings.
 - 1. Continuous with smooth, uniform surface on top and sides for entire length, without sharp corners, projections, or irregularities.
 - 2. Ends returned to walls or terminate at walls to eliminate projection hazards.
 - 3. Free from blemishes or defects that affect durability, strength, or appearance.
- H. Cuts shall be square and accurate for minimum joint gap, clean, straight, and free of chamfer from deburring, burrs, or nicks. Holes, drilled and countersunk to receive fasteners, shall be correct size.
- I. Railing standards shall be single one-piece lengths spaced not over 5 feet apart.
- J. Rails installed on exterior shall have weepholes to prevent entrapment of water.
- K. Rails on exterior and exposed to thermal stress shall have expansion joints not over 20 feet apart.
- L. Fabricate railings in longest lengths possible. If splices are required, locate above bracket.
- M. Corrosion-proofing for Steel.
 - 1. Prime paint interior components.
 - 2. Zinc coat exterior components.
- N. Steel Designated Prime Painted.
 - 1. Clean to comply with SSPC-SP 3.
 - 2. Apply one coat of shop prime paint before leaving shop.
 - 3. Apply two coats of shop prime paint before assembling on surfaces inaccessible for painting after assembly.
 - 4. Smooth, even painted surfaces suitable to receive field coat of paint.
 - 5. Bolts, nuts, welds, and similar unpainted areas, and areas of paint damaged during shipping and erection, field painted after erection with shop coat paint.
- O. Steel Designated Zinc Coated (Galvanized).
 - 1. Hot-dip zinc coating applied to components of designated items in accordance with ASTM A 123.
 - 2. Damaged zinc coated surfaces and fasteners painted with.
 - a. Interzinc 52; International Protective Coatings.
 - b. Zinc Clad 5; Sherwin-Williams.
 - c. Tneme-Zinc 90-97; Tnemec.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Measurements shall be taken at site and not from scale drawings.
- B. Inspect site and become familiar with conditions before starting installation. Make careful study of drawings and become familiar with work constructed by other contractors before and during installation.
- C. Method of erection and distribution of materials before and during erection shall make allowance for obstructions resulting from work by other contractors.

3.02 INSTALLATION

- A. Join components together with tight, even joints.
- B. Anchor and secure handrails, railings, and components. Furnish and install lugs, connections, bearing plates, anchors, and bolts required for erection.
- C. Space brackets for wall mounted railings at not over 4 feet on centers. Secure to walls.

- D. Anchor components to concrete with expansive screw anchors. Each connection to wall shall have three anchors.
- E. Furnish and install ends to wall mounted railings with elbow returning to wall and stopping not more than 1/4 inch from wall surface.
- F. Weld standards of railings to steel framing, curbs, or nosings.
- G. Bolt standards of railings to top of stair and landing stringers with not less than two machine bolts using flanged fittings.
- H. Set standards of railings in steel pipe sleeves of correct size. Fabricate and deliver pipe sleeves or inserts for installation in Section 03 3000. Exclude installation of pipe sleeves or inserts. Set standards in sleeves with lead or Por-Rok.
- I. Standards of railings shall be attached with continuous weld to steel plates embedded in concrete. Fabricate and deliver steel plates. Exclude installation of steel plates from this section.
- J. Set standards of removable railings and guards in sockets constructed from pipe of correct size.
 - 1. Construct sockets of pipe specified for railings and guards.
 - 2. Fabricate and deliver sockets. Exclude installation of sockets from this section.
 - 3. Pipe collar shall be installed to fit tightly between standard and socket. Pipe collar shall be removable by prying with screwdriver.

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rough opening framing for doors, windows, and roof openings.
- B. Sheathing.
- C. Roof-mounted curbs.
- D. Roofing nailers.
- E. Roofing cant strips.
- F. Preservative treated wood materials.
- G. Fire retardant treated wood materials.
- H. Miscellaneous framing and sheathing.
- I. Communications and electrical room mounting boards.
- J. Concealed wood blocking, nailers, and supports.
- K. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

- A. Section 05 1200 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.
- B. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
- C. Section 07 2500 - Weather Barriers: Air barrier over sheathing.
- D. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.
- E. Section 07 7200 - Roof Accessories: Prefabricated roof curbs.
- F. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2010
- C. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2008.
- D. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2009a.
- E. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.
- G. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2010.
- H. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

- C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
- D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

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.
 - 3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: ; 3/4 inch thick plywood; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

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.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 - 2. 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 AWWA standards.

- B. Fire Retardant Treatment:
 - 1. Interior Type A: AWP A U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated.
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

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.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide fire-retardant wood blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Specifically, provide the following non-structural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Chalkboards and marker boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.

3.03 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.04 INSTALLATION OF CONSTRUCTION PANELS

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
- B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 16 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.
 - 4. Size and Location: On all walls of Communications and IT rooms; from 12" to 108" a.f.f.
 - 5. Electrical backboxes: align front of boxes with finish face of backboard to allow device covers to align with face.

3.05 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.06 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 7419.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Custom fabricated cabinet units (millwork).
- B. Cabinet hardware.
- C. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- C. Section 12 3600 - Countertops.
- D. Section 09 9100 - Painting: Site finishing of cabinet

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2009.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.
- C. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).
- D. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; Hardwood Plywood & Veneer Association; 2004 (ANSI/HPVA HP-1).
- E. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.
 - 1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot.
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual samples of all high pressured laminates and edge banding as scheduled.
- E. Samples: Submit digital data sheets for all items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.
- F. LEED Report: Submit for wood products made from sustainably harvested wood, salvaged and reused wood, wood fabricated from recovered timber, and locally-sourced wood, as specified in Section 01 3515.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
- B. Perform work in accordance with AWI/ AWMAC/ WI Architectural Woodwork Standards, Custom quality, unless other quality is indicated for specific items.
- C. Casework and millwork shall be furnished by a single-source manufacturer in order to provide undivided responsibility for all woodwork, including fabrication and finishing.

- D. Measurements: Before proceeding with fabrication of casework and millwork required to be fitted to other construction, obtain measurements and verify dimensions and shop drawing detail for accurate fit.
 - 1. Where sequence of measuring substrates before fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of casework and millwork for accurate fit.
- E. Fire hazard classification data.
 - 1. Components located in exitways and corridors shall be fabricated of materials tested to meet Fire Hazard Classification.
 - a. Test Results (Up to 4 feet above floor) Test Results
(4 feet and above floor) Standard
 - b. Flame Spread 26 - 75 0 - 25 ASTM E84
 - c. Smoke Developed 0 - 450 0 - 450 ASTM E84

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage to AWI Quality Standards, Section 1700, Installation.

1.07 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Economy Grade.
- B. Adjustable Shelf Loading: 50 lbs. per sq. ft.
 - 1. Deflection: L/144.
- C. Cabinet Style: Flush overlay.
- D. Cabinet Doors and Drawer Fronts: Flush style 3/4 inch (19 mm) thick.
- E. Drawer Side Construction: Multiple-dovetailed.
- F. Drawer Construction Technique: Dovetail joints.
- G. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- H. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length. All exposed edges of doors, drawer fronts, front and rear of adjustable shelves, front edge of fixed shelves, and back and end splashes shall be furnished with 3 mm PVC edging. All other exposed edges shall be laminated with high pressure plastic laminated GP 28 of the same color as the interior of the cabinet, door and drawer fronts. Cabinet fronts shall be edged with 1 mm PVC.
- I. Closure panels between top of wall case work and ceiling.
- J. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- K. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.
- B. Provide sustainably harvested wood, certified or labeled as specified in Section 01 6000.
- C. Provide wood harvested within a 500 mile radius of the project site.

- D. Particleboard: ANSI A208.1; medium density industrial type as specified in AWI/AWMAC/WI Architectural Woodwork Standards, composed of wood chips bonded with moisture resistant adhesive under heat and pressure; sanded faces; thickness as required; use for components not indicated as another material.
- E. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC/WI Architectural Woodwork Standards; composed of wood fibers pressure bonded with moisture resistant adhesive to suit application; sanded faces; thickness as indicated.
 - 1. Use as backing for plastic laminate unless otherwise indicated.

2.03 LAMINATE MATERIALS

- A. Manufacturers:
 - 1. Formica Corporation as scheduled: www.formica.com.
 - 2. Panolam Industries International, Inc: www.nevamar.com.
 - 3. Wilsonart International, Inc: www.wilsonart.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- C. Horizontal Surfaces - General Purpose: HGS, 0.048 inch (1.22 mm) nominal thickness, colors as scheduled, finish as scheduled.
- D. Vertical Surfaces: 0.028 inch (0.71 mm) nominal thickness, colors as scheduled, finish as scheduled.
- E. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
 - 3. Plastic shall be laminated to core material under pressure with hydraulic presses and cold setting glue.
 - 4. Plastic laminate shall be applied to all exposed surfaces and to the rear surfaces of doors and drawers. Balance of doors and drawers, etc., shall be finished with CL-20.
 - 5. Balance unexposed surfaces of plastic laminate tops with 0.020" back sheet.
- F. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.
- G. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges, brush apply only.
- H. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness, colors as scheduled, finish as scheduled.
- I. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.04 COUNTERTOPS

- A. Plastic Laminate Countertops: Medium density fiberboard substrate covered with HPDL, with edge banding. See countertop specifications.

2.05 ACCESSORIES

- A. Adhesive: Low VOC, Type recommended by AWI/AWMAC to suit application.
- B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self-locking serrated tongue; of width to match component thickness.
 - 1. Color: As scheduled.
 - 2. Approved Manufacturers:
 - a. Charter Industries: Bob Floyd, 800.538.9088 x 301, www.charterindustries.com

- b. Canplast; 800.277.8888, H.G.H. Hardware Supply, www.canplast.com
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- C. Fasteners: Size and type to suit application, concealed from view.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; stainless steel finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- E. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

2.06 HARDWARE

- A. Hardware: BHMA A156.9, types as scheduled for quality grade specified.
- B. Standards for adjustable shelving.
 - 1. 0.1046 inch (12 gauge) thick steel channel.
 - a. Standard side-mounted system.
 - b. Finish: Satin Chrome Finish.
 - c. Single row of 1/2 inch high slots on 1 inch centers.
 - d. Acceptable products.
 - 1) No. 87 by Knappe & Vogt Manufacturing Co., Grand Rapids, Michigan 49505
www.knappeandvogt.com.
 - 2) Universal Series No. 230 by Crown Manufacturing Co., Elmhurst, Illinois 60126
www.crownmetal.com.
 - 3) Substitutions: See Section 01 6000 - Product Requirements
- C. Drawer and Door Pulls.
 - 1. Drawer and Door Pulls.
 - a. Bar Pull type: 1 inch finger clearance, 3.78 inch center-to-center spacing, 15/32 inch diameter, ADA Compliant.
 - 1) Acceptable products.
 - (a) No. 117.05.600 by Hafele America Co., Archdale, North Carolina 27263
www.hafele.com, 1-800-423-3531.
 - (b) No. BP096-SS by The Engineered Products Company, Flint, Michigan 48501
www.epcohardware.com, 1-888-414-3726.
 - (c) No. DP55A by Doug Mockett & Company Inc., Torrance, California 90501,
www.mockett.com, 1-800-523-1269.
 - (d) Substitutions: See Section 01 6000 - Product Requirements
- D. Drawer slides.
 - 1. Type: Full extension, precision steel ball bearings, cold-rolled slide members on all drawers.
 - 2. Static Load Capacity: Commercial grade; Heavy duty grade required by drawer size.
 - 3. Mounting: Side mounted.
 - 4. Features: Provide self-closing/ stay closed type.
 - 5. Stops: Integral type.
 - 6. Load Rating: 150 pound, drawer removal without use of tools.
 - a. Acceptable products.
 - 1) No. 3320 by Hettich America, L.P., Alpharetta, Georgia 30005
www2.hettichamerica.com, 770-887-3733.
 - 2) No. 8500 by Knappe & Vogt Manufacturing Co., Grand Rapids, Michigan 49505
www.knappeandvogt.com, 800 253 1561.
 - 3) No. 9301 by Accuride International, Inc., Santa Fe Springs, California 90670
www.accuride.com, 562-903-0200.
 - 4) Substitutions: See Section 01 6000 - Product Requirements
- E. Counter brackets.
 - 1. Steel bar L-bracket.

- a. Acceptable product.
 - 1) No. SWS4 by Doug Mockett & Company, Inc., Manhattan Beach, California 90266 www.mockett.com.
 - 2) Substitutions: See Section 01 6000 - Product Requirements
- F. Hinges.
 - 1. European style: Completely concealed when door closed.
 - a. Screw-in installation, built-in horizontal and vertical adjustment.
 - b. Mortised in door only.
 - c. Working parts steel.
 - d. 165-170 degree opening.
 - e. Free swinging.
 - 1) Acceptable products.
 - (a) Modul 100 Series by Julius Blum Inc., Stanley, North Carolina 28164 www.blum.com.
 - (b) System 1000 by Grass America, Inc., Kennersville, North Carolina 27284 www.grassusa.com.
 - (c) 329.19 Series by Hafele America Co., Archdale, North Carolina 27263 www.hafele.com.
 - (d) Substitutions: See Section 01 6000 - Product Requirements
- G. Shelf clips.
 - 1. Pin type to engage drilled holes at 1 inch increments.
 - 2. Zinc-plated steel or molded nylon.
- H. Open wire shelving.
 - 1. Chrome plated.
 - 2. Dimensions, as indicated.
 - 3. Acceptable product.
 - a. Erecta Shelves with wall mounts by InterMetro Industries, Wilkes-Barre, Pennsylvania 18705 www.intermetro.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements
- I. Closet shelving brackets.
 - 1. Steel: 12 gauge, anodized chrome finish.
 - 2. Extra heavy-duty rating.
 - a. 87-187 by Knappe & Vogt Manufacturing Co., Grand Rapids, Michigan 49505 www.knappeandvogt.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements

2.07 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Fabricate and assemble custom casework in accordance with AWI/AWMAC/WI Architectural Woodwork Standards Section 10 - Casework.
- C. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- D. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- E. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 2 feet from sink cut-outs.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

2.08 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.
- C. Finish work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5 - Finishing, for Grade specified and as follows:
- D. Seal, stain and varnish exposed to view surfaces. Brush apply only.
- E. Seal, stain and varnish internal exposed to view and semi-concealed surfaces. Brush apply only.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinets to floor using appropriate angles and anchorages.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.
- B. Clean and polish fabrication surfaces in accordance with manufacturer's instructions.

3.05 PROTECTION

- A. Do not permit construction near unprotected surfaces.
- B. Cover completed work with 4-mil polyethylene film protective enclosure, applied in a manner which will allow easy removal and without damage to woodwork of adjoining work. Cover to be remove immediately before time of final acceptance.

END OF SECTION

SECTION 07 9005
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sealants and joint backing.

1.02 REFERENCE STANDARDS

- A. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2009.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.
- C. Manufacturer's Installation Instructions: Indicate special procedures.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing work of this section with minimum three years documented experience.

1.05 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within 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 SEALANTS

- A. Colors: As selected by Architect-Engineer to match adjacent surfaces.
- B. General Purpose Exterior Sealant: Polyurethane; ASTM C 920, Grade NS, Class 25, Uses M and A; single or multi- component.
 - 1. Color: Match adjacent finished surfaces.
 - 2. Acceptable products.
 - a. Chem-Calk 900 (1 component) or 505 (2 component) by Bostik.
 - b. Dymonic by Tremco.
 - c. Dynatrol I-XL by Pecora.
 - d. Iso-Flex 830 by LymTal.
 - e. Sikaflex-2c NS by Sika.
 - f. Sonolastic Ultra (1 component) or NP 2 (3 component) by Sonneborn.
 - g. Substitutions: See Section 01 6000 - Product Requirements.
 - 3. Applications: Use for:
 - a. Joints between masonry and other materials.
 - b. Joints between metal frames and other materials.
 - c. Other exterior joints for which no other sealant is indicated.

- C. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF single component, paintable.
 - 1. Acceptable products.
 - a. Acrylic Latex Calk AC-20 by Pecora.
 - b. Sonolac by Sonneborn.
 - c. Tremflex 834 by Tremco.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. 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.

2.02 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Backing: Round foam rod compatible with sealant; in accordance with ASTM C 1330 and ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width; Expand-O-Foam manufactured by Williams Products, Inc.; www.williamsproducts.net.
- C. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces and joint openings 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 C 1193.
- D. Protect elements surrounding 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 C 1193.
- C. Use nozzle on caulking gun of proper dimension to suit size of crevice and of proper shape to obtain neat, well finished work. Immediately clean off compound or sealant applied outside joint lines.
- 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 slightly concave at flat surfaces and filleted at corner joints.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect sealants until cured.

END OF SECTION

SECTION 08 1100
METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 09 9100 - Painting and Coating.

1.02 REFERENCE STANDARDS

- A. ANSI A250.4 - American National Standard Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings; 2001.
- B. ANSI A250.6 - Hardware on Standard Steel Doors (Reinforcement--Application); 2003 (R2009).
- C. ANSI A250.7 - Nomenclature: Standard Steel Doors and Frames; 1997 (R2002).
- D. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 2003 (R2008).
- E. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998 (R2004).
- F. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements For; 2009a.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009a.
- H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability; 2010.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability; 2010.
- J. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus; 2005.
- K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).
- L. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.
- M. NFPA 80 - Standard for Fire Doors and Fire Windows; 2010.
- N. SDI 113 - Test Procedure and Acceptance Criteria for Apparent Thermal Performance of Steel Door and Frame Assemblies; 2001 (R2006).
- O. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- P. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop drawings.
 - a. Steel doors.
 - b. Steel frames.
 - c. Details of each opening, showing elevations, frame profiles, and identifying location of different finishes, if any.

- C. For Information.
 - 1. Product data.
 - a. 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.
- D. Installation Instruction:
 - 1. Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate:
 - 1. Certification that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

- A. Construct doors to pass ANSI A250.4 procedure for twist test with maximum pressure of 300 pounds.
- B. Fabricate doors and frames scheduled to bear fire or temperature rating label (1/3, 3/4, 1, or 1-1/2 hour) in accordance with applicable requirements of National Fire Protection Association (NFPA) and attach label of accredited Nationally Recognized Testing Laboratory (NRTL) by Occupational Safety and Health Administration of U.S. Government (UL, ITS-WH, etc.) for class opening designated in door schedule.
- C. NFPA requirements have precedence over other provisions of this Section.
- D. Test doors and frames in compliance with applicable requirements of NFPA 80.
- E. For fire-rated doors, temperature rise on unexposed surface may be in excess of 650 degrees F.
- F. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- G. Maintain at the project site a copy of all reference standards dealing with installation.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

1.06 WARRANTY

- A. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Doors and Frames.
 - 1. Ceco Door Products, Milan, Tennessee 37027 www.cecodoor.com.
 - 2. Mesker Door, Inc., Huntsville, Alabama 35811 www.meskerdoor.com.
 - 3. Steelcraft, a division of IR Security and Safety, Cincinnati, Ohio 45242 www.steelcraft.com.
 - 4. Republic Doors and Frames, McKenzie, Tennessee 38201 www.republicdoor.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Steel Components.
 - 1. For internal reinforcing, hot rolled steel sheets, commercial quality, carbon steel, in accordance with ASTM A1011, pickled and oiled.
 - 2. For prime painted components, cold rolled steel sheets, commercial quality, carbon steel, in accordance with ASTM A1008 and A568.

3. For zinc coated components, cold rolled steel sheets, commercial quality, carbon steel, in accordance with ASTM A653, hot dipped zinc-coated, G 60 coating designation.
 4. Free of scale, pitting or other surface defects.
 5. Stretcher level degree of flatness.
- B. Primer in accordance with ANSI A 250.10.
- C. Mineral Wool for Steel Frames in Steel Stud Walls.
1. Unfaced, semi-rigid mineral fiber mat.
 2. Fire-resistant.
 3. Acceptable product.
 - a. Thermafiber Sound Attenuation Fire Blanket by Thermafiber, Inc.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. Glass: In accordance with criteria in Section 08 8000.

2.03 MANUFACTURED UNITS

- A. Steel Door, Heavy-Duty, Insulated (SD-HD-IN).
1. Model 1: Full flush design.
 2. Level 2, heavy-duty in accordance with ANSI A 250.8.
 3. Face sheet thickness: Not less than 0.042 inch (18 gauge).
 4. Core construction for Physical Performance Level B in accordance with ANSI A250.4.
 5. Insulation R value: Not less than 12.5 when tested in accordance with ASTM C1363 and SDI 113.

2.04 FABRICATION

- A. Steel Doors (SD).
1. In accordance with ANSI A250.8, unless more stringent criteria are specified in this Section.
 2. Fabricate to widths and heights indicated in door schedule, less allowance for specified clearance.
 3. Thickness: 1-3/4 inches unless scheduled otherwise.
 4. Clearance between doors and frame.
 - a. At head and jamb: Not more than 1/8 inch.
 - b. At meeting edges of pairs of doors: Not more than 1/8 inch.
 - c. Referenced clearance dimensions are nominal and subject to specified manufacturer's tolerance.
 - d. Design lock edges of doors for correct operating clearance.
 5. Clearance between door and sill.
 6. Tolerances.
 - a. Thickness: Plus or minus 1/16 inch.
 - b. Width and height: Plus or minus 3/64 inch.
 - c. Hinge to door edge: Plus or minus 1/32 inch.
 - d. Hinge to hinge centerline: Plus or minus 1/64 inch, noncumulative.
 - e. Lock height: Plus or minus 1/32 inch.
 - f. Squareness, diagonal measurements from corner to corner: Vary not more than plus or minus 1/16 inch.
 - g. Flatness, both sides of door.
 - 1) At vertical and horizontal centerlines: Not more than plus 3/16 inch minus 0 inch under 6-foot straightedge.
 - 2) At vertical 1 inch from hinge edge and 1 inch from lock edge: Not more than plus or minus 1/16 inch under 6-foot straightedge.
 7. Internal construction of doors: Manufacturer's standard to comply with performance requirements of doors.
 8. Construction.
 - a. Full flush in accordance with Model 1, ANSI A250.8.

- b. Form face sheets from one sheet of steel.
 - c. Locate seams on vertical door edges.
 - d. Close top and bottom of door with recessed channel welded in place.
 - 9. Corrosion protection.
 - a. Interior: Prime painted.
 - b. Exterior: Zinc coated and prime painted.
 - 10. Edge profiles on both vertical edges of doors.
 - a. At single-acting swing doors: Beveled, 1/8 inch in 2 inches.
 - 11. Hardware reinforcement.
 - a. Reinforce doors for mortise hardware.
 - b. For surface mounted hardware: Weld to inner surface.
 - c. Minimum thicknesses for hardware reinforcing plates.
 - 1) Hinge and pivot reinforcements: 0.1703 inch.
 - 2) Lock face, flush bolt, concealed holder, concealed or surface mounted closer reinforcements: 0.0994 inch.
 - 3) Other surface mounted hardware reinforcements: 0.053 inch.
 - 12. Hardware preparation.
 - a. For mortise hardware: Punch, mortise, drill and tap in accordance with templates to be furnished by hardware supplier.
 - b. For surface applied hardware: Drilling and tapping will be done in field.
 - c. Door manufacturer shall prepare fire rated, temperature rated and smoke barrier doors for hardware in accordance with service procedures approved by testing laboratory (NRTL) granting labels for doors.
- B. Steel Frames (SF).
- 1. In accordance with ANSI A250.8, unless more stringent criteria are specified in this Section.
 - 2. Material for frames to receive prime paint: Commercial grade cold-rolled steel in accordance with ASTM A1008 or commercial grade hot-rolled steel in accordance with ASTM A1011.
 - 3. Material for zinc coated frames: Commercial quality, carbon steel, in accordance with ASTM A653 hot dipped, zinc coated, G 60 coating designation.
 - 4. Corrosion protection.
 - a. Interior: Prime painted.
 - b. Exterior: G60 hot dipped galvanized; prime painted.
 - 5. Metal thickness for interior locations: Not less than 0.053 inch (16 gauge) (SF-HD).
 - 6. Metal thickness for exterior locations: Not less than 0.053 inch (16 gauge) (SF-HD).
 - 7. Metal thickness for frames over 4 feet wide: Not less than 0.025 inch thicker than thickness specified accordance with ASTM A1011.
 - 8. Profiles: Sharply bent and formed to shapes shown on Contract drawings.
 - 9. Stops: Not less than 5/8 inch.
 - 10. Corners.
 - a. Die-cut, mitered.
 - b. Continuously weld intersection of jambs and heads including rabbets and stops. (Knock-down frames are not acceptable.)
 - c. Grind smooth and flush with no visible joints.
 - d. Joints: Nonvisible.
 - 11. Jamb anchors.
 - a. At steel studs.
 - 1) Wide Z-anchors designed to fit steel studs used in wall.
 - 2) Material: Minimum 0.042 inch thick steel.
 - 3) Length equal to stud depth, by width equal to steel face dimension less 3/8 inch, with 1-1/2 inch flanges.
 - 4) Securely weld inside each jamb.
 - 5) One each jamb, for each 2 feet 6 inches or fraction of frame height.

12. Base anchors.
 - a. At each jamb.
 - b. Thickness: Not less than 0.042 inch.
 - c. Adjustable or securely welded to inside surface using shims for alignment.
 - d. With 2 holes for anchorage to floor.
13. Hardware reinforcement.
 - a. Steel plates: Welded in place.
 - b. For hinges and pivots: Not less than 0.1703 inch thick, 1-1/4 inches by 10 inches minimum size.
 - c. For strikes, flush bolts, concealed or surface mounted closers: Not less than 0.0994 inch thick.
14. Hardware preparation.
 - a. For mortise hardware: Punch, mortise, drill and tap in accordance with templates furnished by hardware supplier.
 - b. For surface mounted hardware: Weld reinforcement to inner surface ready for drilling and tapping in field.
 - c. Frame manufacturer shall prepare fire-rated frames for hardware in accordance with service procedures approved by the testing laboratory (NRTL) granting labels for the frames.
15. Plaster guards: Weld in place.
16. Equip with silencers.
 - a. Gray molded rubber.
 - b. Quantity: 3 in latch jamb of single door frame.
17. Corrosion protection.
 - a. Grind, fill, and dress welds to make joints and welds invisible and provide a smooth flush surface.
 - b. Chemically treat zinc-coated surfaces.
 - c. Thoroughly clean metal surfaces.
 - d. Dip or spray coat with primer after fabrication.
 - e. Leave surfaces smooth and ready to receive final paint finish.
 - f. Exclude final paint finish from this Section.
 - g. Do not apply any paint to rated label attached to steel components.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Steel Frames.
 1. Frame fill: Fill head and jamb members with mineral wool prior to installation in metal stud walls.
 2. Set accurately in position, align, plumb, square, and brace securely with wood bracing or metal jacks designed for purpose.
 3. At door frames.
 - a. Use temporary wood spreaders, not less than 3/4 inch thick and cut to accurate dimension, at mid-height and sill.
 - b. Remove temporary metal shipping bars prior to installation.
 - c. Check frame for squareness and alignment, then secure floor anchors to floor slab with 2 fasteners per anchor.
 - d. Maintain bracing until frame is permanently built into wall with anchors properly installed.
 - e. Dismantle bracing and spreaders and remove from project site.
 - f. Do not scratch, dent, or otherwise damage during installation.
 4. Prime paint abrasions with rust-inhibiting metal primer.
- B. Steel Doors.
 1. Install plumb with uniform clearance at jambs and head, and to open and close without binding.

2. Cut, drill, and tap as required to install surface applied hardware.
3. Attach hardware accurately and securely.
4. Check Hardware Schedule to ensure that templates and details conform.

END OF SECTION

SECTION 08 1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush configuration; rated and non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware.
- B. Section 08 8000 - Glazing.
- C. Section 09 2100 - Gypsum Board Assemblies.
- D. Section 09 9000 – Painting.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2009.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2009.
- C. ASTM C 1036 - Standard Specification for Flat Glass; 2006.
- D. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass; 2004.
- E. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- F. ASTM E 413 - Classification for Rating Sound Insulation; 2004.
- G. ASTM E 1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; 1991 (Reapproved 2000).
- H. AWI (QCP) - Quality Certification Program, www.awiqcp.org; current edition at www.awiqcp.org.
- I. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.
- J. UL (BMD) – Building Materials Directory; Underwriters laboratories Inc.; current edition.
- K. NFPA 80 – Standard for Fire Doors and Other Opening Protectives; 2013.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. For Information.
 - 1. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. For Review.
 - 1. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
 - a. Provide information required by AWI/AWMAC/WI Architectural Woodwork Standards.
 - b. Include certification program label.
 - c. Specimen warranty.
 - d. Test Reports: Show compliance with specified requirements for following:
 - 1) Sound-retardant doors and frames; sealed panel tests are not acceptable.
 - 2. Samples for Verification: Submit two samples of door veneer, 12 x 12 inches in size illustrating wood grain, stain color, and sheen.
- D. Certificates.
 - 1. Door fabrication in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.
 - 2. Manufacturer's Installation Instructions: Indicate special installation instructions.

- E. Warranty, executed in OWNER's name.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years of documented experience.
 - 1. Company with at least one project in past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
 - 2. Accredited participant in specified certification program prior to commencement of fabrication and throughout duration of project.
- C. Quality Certification: Provide AWI Quality Certification Program inspection report and quality certification of completed work.
 - 1. Provide labels or certificates indicating that work complies with requirements of AWS Grade or Grades specified.
 - 2. Prior to delivery to site provide shop drawings with certification labels.
 - 3. Provide labels on each product when required by certification program.
 - 4. Upon completion of installation provide certificate certifying that installation and products meet the specified requirements.
 - 5. Arrange and pay for inspections required for certification.
 - 6. Replace, repair, or rework work for which certification is refused.
- D. Safety glass shall comply with governing safety glazing laws, and be permanently labeled as required by CPSC 16 CFR Part 1201.
- E. Install Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.06 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.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors (WD-1):
 - 1. Algoma Hardwoods, Inc.: www.algomahardwoods.com.
 - 2. Graham Wood Doors: www.grahamdoors.com.
 - 3. Eggers Industries: www.eggersindustries.com.
 - 4. Marshfield Door Systems, Inc: www.marshfielddoors.com.
 - 5. VT Industries, Inc.: www.vtindustries.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS

- A. All Doors: See drawings for locations and additional requirements.
 - 1. Quality Level: Premium Grade, in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.
 - 2. Wood Veneer Faced Doors: 5-ply; 7 ply. construction is not acceptable.
 - 3. Must be solid core wood.

- 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 60 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated above.
- B. Sound Retardant Doors: Equivalent to Type PC construction with core as required to achieve rating specified; plies and faces as indicated above.
- C. 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. Wood Veneer Facing for Transparent Finish: White birch, veneer grade as specified by quality standard, rotary cut, book veneer match, running assembly match.
 - 1. Provide two-ply stiles with minimum 1/4-inch solid matching lumber after presizing for door width. Veneered edges will not be accepted
 - 3. Pairs: Pair match each pair; set match pairs within 10 feet of each other when doors are closed.
- B. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
 - 2. Provide solid blocking for other through bolted hardware.
- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
 - 1. Prefit and mortise for hardware.
 - 2. Templates to be furnished by hardware supplier.
 - 3. Door manufacturer shall design and fabricate conduit/wire path within certain wood doors for electronic hardware.
 - 4. Refer to door elevations on drawings.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- E. Door Edge Profiles.
 - 1. Single acting swing doors: Both vertical edges beveled, 1/8 inch in 2 inches.
 - 2. Double acting swing doors: Both vertical edges rounded on 2-1/8 inch radius.
- F. Provide edge clearances in accordance with quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

- A. Finish work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 5 - Finishing, for Grade specified and as follows:
 - 1. Transparent:
 - a. System - 5, Varnish, Conversion.
 - b. Stain: Color options to match existing, sample to be submitted and accepted by Interior Designer prior to ordering.
 - c. Sheen: Satin.
- B. Factory finish doors in accordance with approved sample.
- C. Stain and varnish edges and face veneers.
- D. Seal door top and bottom edge with color sealer to match door facing.

2.07 ACCESSORIES – DOOR GLAZING & LABELS

- A. Door Labels.
 - 1. Machine printed labels on clear background.
 - a. Use door number as indicated on Contract Documents.
 - b. Black lettering for non-fire-rated doors.
 - c. Red lettering for fire-rated doors.
 - d. Apply to butt of door below upper hinge, but do not cover or alter manufacturer-applied code-required fire or smoke rating labeling.
 - 2. Required for following types of doors.
 - a. Cross-corridor doors required by code (fire- or smoke- rated).
 - b. Cross-corridor doors not required by code.
- B. Glass Lights.
 - 1. Dimensions: As indicated on drawings.
 - 2. Cutouts: Not less than 6 inches from edge of door or other cutouts/blocking for hardware, unless otherwise indicated.
 - 3. Seal edges of cutouts before installing lights.
 - 4. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

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 plumb with uniform clearance at jambs and head, and to open and close without binding.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Check hardware schedule to ensure that templates and details conform. Use machine tools to cut or drill for surface applied hardware. Attach hardware accurately and securely.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. 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.

END OF SECTION

SECTION 08 3613
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Overhead sectional doors, manually operated.
- B. Operating hardware and supports.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers: Perimeter sealant and backup materials.
- B. Section 09 9100 - Painting: Finish painting.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- B. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; Door & Access Systems Manufacturers' Association, International; 2011.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. Product Data: Show component construction, anchorage method, and hardware.
- C. For Review.
 - 1. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
 - 2. Samples: Submit two panel finish samples, 12 x 12 inch in size, illustrating color and finish.
- D. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
- E. Test Report: Operating test.
- F. Operation Data: Include normal operation, troubleshooting, and adjusting.
- G. For Closeout.
 - 1. Maintenance Data: Include data for transmission, shaft and gearing, lubrication frequency, spare part sources.
 - 2. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Equipment shall comply with laws and ordinances of local or state inspection departments having legal jurisdiction over this class of work.
- B. Design Requirements: Design doors to withstand wind pressure of 20 pounds per square foot of door area without appreciable deflection, even though door is mounted within building.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- D. Installer: Company specializing in performing the work of this section with minimum three years of experience.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sectional Doors.
 - 1. Overhead Door Corporation: www.overheaddoor.com.
 - 2. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com.
 - 3. Windsor Doors: www.windsordoor.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SYSTEM

- A. Design Requirements.
 - 1. Industrial grade.
 - 2. Exterior applications.
 - a. Resist 27 psf wind load inward and outward for exterior applications.
- B. Method of Operation 1, (MO-1).
 - 1. Manual, chain.
 - a. Design for easy, uniform effort.
 - b. Plated chain or lever within reach of floor.

2.03 MANUFACTURED UNITS

- A. Sectional Door, Steel, Insulated (S-ST-IN).
 - 1. Material: Steel, hot dipped zinc coated in accordance with ASTM A653, Designation G140.
 - a. Gauge: 24.
 - 2. Isocyanurate insulation to achieve R-value of not less than 11.5.
 - 3. Weatherstripping to achieve air infiltration of less than 0.13 cubic feet per minute at 25 miles per hour.
 - 4. Thermal break between internal and external facing.
 - 5. Factory finished in prepainted steel, color as selected by Architect-Engineer.
 - 6. Panel Thickness: 2 inch nominal.
 - 7. Meeting rails with rolled weathering type shiplap joints designed to act as interlocking struts for full length of sections.
 - 8. Furnish steel frames with rubber mounting cushions at glazed sections.
 - 9. Lexan.
 - a. Furnish U-shaped rubber astragals, enclosing safety edge, at bottom of doors.
 - b. Accurately fit and install with accessories for normal electrical operation and incidental manual operation.
- B. Hardware.
 - 1. Furnish and install standard lift tracks, mounting brackets, rollers, hinges, and hardware necessary for complete operation of doors.
 - 2. Connect horizontal tracks to vertical tracks by means of not less than 15 inch radius, reinforced with continuous angle not less than 2-1/2 inches by 2-1/2 inches by 3/16 inch connected to jambs, and hung from structure above with hangers furnished and installed under this heading.
 - 3. Furnish and install vertical lift tracks, mounting brackets, rollers, hinges, and hardware necessary for complete operation of doors.
 - 4. Mount vertical tracks on not less than 1/4 inch thick continuous steel angle of suitable strength and rigidity for size and weight of door.
 - 5. Do not use intermittent brackets.
 - 6. Hardware shall be heavy-duty for industrial use.
 - 7. Tracks shall be rolled to special shapes using nominal 0.125 inch thick steel formed to receive nominal 3 inch diameter double row ball bearing type rollers.

- C. Door Operation.
1. When closed, fit snug against frame, completely sealing opening.
 2. When open, free from frame and remain completely free during opening or closing operation until completely closed.
 3. Accomplish task by utilizing one of following methods.
 - a. Slanting vertical track away from frame and use hinges of progressively graduated heights.
 - b. Use weathering device applied to inside face of jamb.
 - c. Use method accepted by Owner's Field Representative.
 4. Door is to clear opening completely when open.
 5. Counterbalance door with counterweights, enclosures, and collateral steel required for complete operation.
 - a. Material: Steel or cast iron of sufficient weight to balance door.
 - b. Bolt or weld enclosures together to form continuous steel guides.
 - c. Cover bottom of enclosure with 1/8 inch steel plate to height of 8 feet.
 - d. Bolt cover plates to enclosure with flat head machine screws to allow access to weights.
 - e. Locate counterweights at one side of door opening.
 - f. Include continuous steel shafts, drums, sheaves, and operating equipment at head of respective door opening, of size and strength to ensure securement to steel framing and construction in substantial manner.
 - g. Cables.
 - 1) Galvanized aircraft cable with fiber core.
 - 2) Minimum 7 x 19, 3/16 inch size to provide safety factor of 10 to 1.
 - 3) Incorporate safety devices to instantly lock door in position should supporting cables break.
 - h. Furnish and install continuous bar on inside face of head jamb to compensate for thickness of track mounting if door contacts mounting when closed.
 6. Rollers.
 - a. Seamless, case-hardened, double row ball bearing.
 - b. 1/2 inch hardened steel pins.
 - c. Carried on heavy-duty malleable iron supports for engagement in end hinges.
 - d. Nominal 3 inch diameter.
 7. Single-sleeved double hinges or heavy-duty single hinge at ends of joints to receive rollers.
 8. Furnish intermediate hinges at alternate stiles, and not more than 4 feet apart, arranged in symmetrical locations.
 9. Hinges: Fabricate of 0.0852 inch thick steel to measure not less than 8 inches measured from end to end.
 10. Furnish and install supports for overhead tracks, made of angles, channels, or construction suited to conditions and acceptable to Owner's Field Representative.
 11. Furnish cushion type rubber weatherstrip and concealed rubber bumper tips at bottom of doors.
 12. Hardware: Zinc coated in accordance with ASTM A653, coating Designation G90.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

3.02 PREPARATION

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

3.03 INSTALLATION

- A. General.
 - 1. Cooperate with Mechanical Contractor to avoid interference with piping, when installing hangers, prior to installation of ceiling.
 - 2. Furnish and install brackets, fastening devices, hangers, struts, expansion bolts, and supporting structural steel required and not specifically indicated on drawings as furnished and installed by other contractors.
 - 3. Drill and tap frames and correlated work to erect overhead doors.
 - 4. Clamp steel supports to structural beams.
 - 5. Drilling or welding is unacceptable.
- B. Painting.
 - 1. Clean iron and steel and apply 1 coat of metal protective paint before leaving shop.
 - 2. Surfaces, inaccessible for painting after assembling, shall be given 2 coats of paint before assembling.
 - 3. Painted surfaces shall be smooth, even, and suitable to receive field coat of paint.
 - 4. After erection, field paint bolts, nuts, welds, and areas left unpainted with 1 coat of shop coat paint.
 - 5. Field paint painted areas damaged during shipping and erection with 1 coat of shop coat paint.
 - 6. Acceptable products.
 - a. Kromik Primer by Sherwin-Williams.
 - b. 99 Red Metal Primer by Tnemec.
 - c. Substitutions: See Section 01 6000 - Product Requirements

3.04 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 9005.
- F. Install perimeter trim.

3.05 TOLERANCES

- A. Maximum Variation from Plumb: 1/16 inch.
- B. Maximum Variation from Level: 1/16 inch.
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

3.06 FIELD QUALITY CONTROL

- A. Perform Tests of Operating Equipment.
 - 1. Upon completion of installation of overhead doors, in presence of Owner's Field Representative.
 - 2. Obtain acceptance of work.
- B. Doors in closed position shall withstand wind load of 27 pounds per square foot and deflection limited to 1/120 of span.

3.07 ADJUSTING

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.
- B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.08 CLEANING

- A. Clean doors and frames.
- B. Remove temporary labels and visible markings.

3.09 PROTECTION

- A. Protect installed products from damage during subsequent construction.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Infill panels of glass.
- C. Aluminum doors and frames.
- D. Weatherstripping.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.
- B. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- C. Section 08 8000 - Glazing: Glass and glazing accessories.
- D. Section 09 9000 - Painting and Coating: Field painting of interior surface of infill panels.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association ; 2004.
- B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; American Architectural Manufacturers Association ; 2009 (part of AAMA 501).
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association ; 1998.
- D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; American Architectural Manufacturers Association ; 2009.
- E. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers ; 2010.
- F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel ; 2008.
- G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products ; 2009.
- H. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate ; 2007.
- I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes ; 2008.
- J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric] ; 2007.
- K. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen ; 2004.
- L. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference ; 2002 (Reapproved 2010).
- M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference ; 2000 (Reapproved 2009).
- N. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II; Society for Protective Coatings ; 1997 (Ed. 2004).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details .
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
- D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, dimensional limitations.
- E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- F. Samples: Submit two samples 12x12 inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.
- G. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- H. Report of field testing for water leakage.
- I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the State in which the Project is located.
- B. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum 5 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: See below under description of products.

- B. Oldcastle Building Envelope; www.oldcastlebe.com ; Exterior Product Series 3000 Thermal Multiplane - Center Set.
- C. Other Acceptable Manufacturers:
 - 1. YKK AP America Inc ; Product YES 45 XT: www.ykkap.com.
 - 2. Kawneer North America ; Product Encore 4-1/2" System - Center Glazed: www.kawneer.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STOREFRONT

- A. Aluminum-Framed Exterior Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Glazing Position: Centered (front to back).
 - 2. Vertical Mullion Dimensions: 2 inch x 4-1/2 inch.
 - 3. Water Leakage Test Pressure Differential: 10 lbf/sq ft.
 - 4. Air Infiltration Test Pressure Differential: 6.24 psf.
 - 5. Overall U-Value Including Glazing: 0.56, maximum.
 - 6. Finish: Class I color anodized.
 - 7. Color: As selected from manufacturer's standards.
- B. Performance Requirements:
 - 1. Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Design Wind Loads: Comply with requirements of IBC 2010 code.
 - b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
 - 2. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 - 3. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at specified differential pressure across assembly in accordance with ASTM E283.
 - 4. Condensation Resistance Factor: Measure in accordance with AAMA 1503 with 1 inch insulating glass installed.
 - 5. Water Leakage: None, when measured in accordance with ASTM E331 at specified pressure differential.
 - 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections , thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 - 1. Glazing stops: Compression type design, replaceable, molded or extruded, of neoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM). Profile and hardness as required to maintain uniform pressure for watertight seal.
- B. Doors: Glazed aluminum.
 - 1. Basis of Design: Oldcastle MS 375T Series Thermal Aluminum Doors
 - 1. Material Thickness: .125"
 - 1. Thickness: 1-3/4 inches.
 - 2. Top Rail: 3 1/2 inches wide.

3. Vertical Stiles: 4 inches wide.
4. Bottom Rail: 8 1/2 inches wide.
5. Glazing Stops: Square Extruded Aluminum.
6. Finish: Same as storefront.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Structural Steel Sections: ASTM A36/A36M; shop primed.
- C. Fasteners: Aluminum, non-magnetic stainless steel.
 1. Provide concealed fasteners wherever possible.
 2. For exposed fasteners, provide Phillips flathead screws with finish matching item fastened.
 3. For concealed locations, provide manufacturer's standard fasteners.
- D. Exposed Flashings: 0.032 inch thick aluminum sheet; finish to match framing members.
- E. Concealed Flashings: 0.018 inch thick aluminum.
- F. Glass: As specified in Section 08 8000.
- G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- H. Glazing Accessories: As specified in Section 08 8000.
- I. Shop and Touch-Up Primer for Steel Components: SSPC-Paint 25, zinc oxide, alkyd, linseed oil primer.
- J. Brake Metal Trim: formed from 0.018 inch minimum thickness aluminum-zinc alloy coated sheet pre-painted with coil coating. Locations include section between aluminum storefront framing sections and around structural framing members at those locations.

2.05 FINISHES

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils thick.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 HARDWARE

- A. Door Hardware: As specified in Section 08 7100.
- B. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- C. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
- D. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

2.07 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- E. Arrange fasteners and attachments to conceal from view.
- F. Reinforce components internally for door hardware.
- G. Reinforce framing members for imposed loads.
- H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
 1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Install glass and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.
- K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.
- B. Test installed storefront for water leakage in accordance with AAMA 501.2.

3.05 ADJUSTING

- A. Adjust operating hardware for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- C. Remove excess sealant by method acceptable to sealant manufacturer.

3.07 PROTECTION

- A. Protect installed products from damage during subsequent construction.

END OF SECTION

SECTION 08 7100

DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hardware for wood doors.
- B. Hardware for fire-rated doors.
- C. Electrically operated and controlled hardware.
- D. Lock cylinders for doors for which hardware is specified in other sections.
- E. Thresholds.
- F. Weatherstripping, seals and door gaskets.

1.02 RELATED REQUIREMENTS

- A. Section 08 1100 - Metal Doors and Frames.
- B. Section 08 1400 - Flush Wood Doors.

1.03 REFERENCE STANDARDS

- A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2003.
- B. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; Door and Hardware Institute; 2004.
- C. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; Door and Hardware Institute; 1996.
- D. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association; 2007.
- E. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2006.
- F. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.
- B. Convey Owner's keying requirements to manufacturers.
- C. Pre-installation Meeting: Convene a pre-installation meeting one week prior to commencing work of this section; require attendance by all affected installers.
- D. General Standards.
 - 1. ANSI A156.1 Butts & Hinges
 - 2. ANSI A156.3 Exit Devices
 - 3. ANSI A156.4 Door Closers
 - 4. ANSI A156.6 Door Trim
 - 5. ANSI A156.13 Mortise Locks/Latches
 - 6. ANSI A156.21 Thresholds
 - 7. ADA Public Law - 1992
 - 8. All prevailing City, County State and other applicable Codes.

1.05 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Hardware Schedule.
 - 1. Complete materials list of all items proposed to be furnished and delivered under this Section.
 - a. Identify each item by manufacturer, catalog number and location in the work, using door designation shown on drawings.
 - b. Make schedule in vertical format to facilitate checking by Architect. Furnish a minimum of five (5) sets of this Schedule.
 - c. Architect's approval of hardware schedule shall not relieve Contractor of the responsibility to furnish necessary hardware.
- C. Manufacturer's Product Data: Indicating full compliance with requirements of this Section.
 - 1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts..
 - 2. Submit manufacturer's parts lists, templates, and other required submittal data. Provide a minimum of five (5) sets of submittal data.
 - 3. Substitutions: Substitutions WILL NOT be accepted after bidding of the project. Refer to Section 01 6000 for substitution requirements and the time required for submittal for substitutions.
- D. Samples: Prior to preparation of hardware schedule:
 - 1. Submit 1 sample of hinge, latch set, lockset, closer, and other hardware illustrating style, color, and finish.
 - 2. Samples will be returned to supplier and may be included in the work.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and templates. For items requiring special field preparation, submit five (5) copies.
- F. Templates: After hardware schedule is approved, deliver hardware templates or physical samples to pertinent suppliers of interfacing items such as doors and frames.
- G. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- H. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
 - 1. Tools for Maintenance: Furnish a complete set of specialized tools as needed for Owner's continued adjustment, maintenance and removal and replacement of builders hardware.
- I. Keys: All keys and permanent cylinders are furnished by the owner.
- J. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.
 - 1. Provide hardware for the fire-rated openings in compliance with NFPA standard No. 80. Provide only hardware which has been tested and listed by UL for the types and sizes of doors required and complies with the requirements of the door and door frame labels. Furnish door closers, ball bearing hinges and positive latch/lock on all UL doors.
 - 2. Where emergency exit devices are required on fire rated doors (with supplementary marking on door UL label indicating "Fire door to be equipped with fire exit hardware"), provide UL label on exit device indicating "Fire exit hardware".

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- C. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware with 10 years of experience.
 - 1. This firm shall employ at least one full time qualified Architectural Hardware Consultant (AHC) who is a current member of the Door and Hardware Institute (DHI) of Chantilly, Virginia, available to the Architect and General Contractor for consultation as required to complete the work.
 - 2. All submittals must bear signature of an AHC.
- D. The General contractor shall retain the services of the factory representative of each hardware component selected and, through the representative, certify that all hardware is installed and operating per manufacturer's requirements.
- E. For the purpose of designating the minimum aesthetic, functional and quality standards for the work of this section, proprietary products are specified.
- F. Substitutions.
 - 1. Products of manufacturers listed in this Section are acceptable only after compliance with the requirements of this Section.
 - 2. Products of manufacturers not listed in this section are acceptable for evaluation only after compliance with substitution requirements.

1.07 PRE-INSTALLATION MEETING

- A. Convene one week prior to commencing work of this section. This meeting is to be attended by the Owner, the Architect, the AHC, and the manufacturer's hardware representative. The purpose of the meeting is to clarify time for certification and inspections and acceptable quality levels expected at Substantial Completion. Owner to clarify keying requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule. Individually package each unit of finish hardware, complete with proper fastenings and appurtenances, clearly marked on the outside to indicate the contents and specific locations in the work. The hardware supplier shall meet at the jobsite with the installer prior to commencing installation of hardware for explanation of packing, labeling and hardware schedule data, if required.
- B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and Owner and at no additional cost to the Owner.

1.09 COORDINATION

- A. Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware.
- B. Furnish templates for door and frame preparation.
- C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- D. Coordinate Owner's keying requirements during the course of the work.

1.10 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 10 year warranty for door closers and one (1) year on all other items.

1.11 MAINTENANCE PRODUCTS

- A. Provide special wrenches and tools applicable to each different or special hardware component.
- B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 PRODUCTS

2.01 HARDWARE

- A. Finish: Finishes are to be as follows:

1. Hinges	US26D
2. Exit Devices/ Push/Pulls Plates	US26D
3. Closers	Sprayed Aluminum
4. Thresholds	Aluminum
5. Locks	US32D
6. Kickplates	US32D
- B. HARDWARE SETS.
 - 1. The following hardware sets are listed as a guide to requirements. Locksets, closers and other critical items of hardware are scheduled by model number to establish operating characteristics. It shall be the responsibility of the hardware supplier to provide additional hardware in accordance with this Section for proper function of the door(s).
 - 2. Refer to the door schedule, included in the drawings, for reference to the hardware set required for each door. The full intent of this specification shall apply. Substitution restrictions shall be strictly adhered to.
 - 3. Approved manufacturers include the following:

a. Locksets	Best
b. Door stops	Rockwood
c. Closers	LCN
d. Push/Pulls	Rockwood
e. Door Release/OH Holders	Rixson
f. Panic Devices	Von Duprin
g. Electric Strikes	HES
h. Electronic Accessories	Securitron
i. Hinges	Hager

2.02 MANUFACTURERS

- A. Hinges: Butt hinges are to be by McKinney, Stanley or Hager. Additional Manufacturers may be submitted to UPL for review. Provide three 4-1/2 inches by 4-1/2 inches hinges for each door up to 7 feet 0 inches high. Provide one extra hinge for each additional 18 inches or part thereof over 7 feet high. All doors are 1-3/4 inches thick.
 - 1. Assa Abloy McKinney: www.assaabloydss.com.
 - 2. Hager Companies: www.hagerhinge.com.
 - 3. Stanley Hardware: www.stanleyworks.com.
 - 4. Continuous gear hinges shall be manufactured of extruded 6063-T6 aluminum alloy/temper.
 - 5. All hinges shall be manufactured to template screw locations and be non-handed.
 - 6. Thrust bearings shall carry the vertical loads and be completely concealed by the gear cap the full length of the hinge.
 - 7. All mortise hinges shall cover and wrap the edge of door completely.
 - 8. All hinges shall be tested by a certified independent testing laboratory to 1,500,000 cycles and certified functional, ANSI 156.1.
 - 9. Bearings are not to be installed in hinges before electro-plating the hinge. If frozen bearings are found, general contractor will be required to replace the complete shipment.

B. Lock and Latch Sets.

1. Acceptable manufactures: Best or Ingersoll Rand – Substitutions are not acceptable.
2. Lever trim shall have solid levers; no filled or Hollow Levers will be accepted.
3. The contractor will provide all permanent cylinders for the locksets. The contractor must test cylinders in the hardware to verify that the lockset is functioning properly.
4. No plastic parts in locksets are allowed.
5. All hardware must accept Best 7-pin interchangeable cores cylinders.
6. During the design phase the designer shall consult with the Facilities Division - Access Control Department to discuss the specific requirements for card access and locks with regard to each project.
7. Mortise type locks and latches shall be heavy-duty with 3/4 inch throw latch bolt.
8. Deadbolt functions shall be 1 inch projections made of hardened stainless steel.
9. Both deadbolt and latch bolt are to extend into the case a minimum of 3/8 inch when fully extended.
10. Furnish locksets and latch sets with sufficient curved strike lip to protect door trim.
11. Provide locksets with Best 7-pin interchangeable core cylinders. All mortise cylinders shall have a concealed internal set screw for securing the cylinder to the body.
12. All mortise locksets must conform to ANSI A156.13, series 1000 operational Grade 1 and be listed by UL. Locksets must fit ANSI A115.1 door preparation.
13. Locks and latches to have self-aligning, thru-bolted trim.
14. Auxiliary dead latch to be made of one piece stainless steel permanently lubricated.
15. Levers handles must be forged or cast brass, bronze, or stainless steel construction and conform to ANSI A117.1.
16. Spindle to be such that it will twist first then break, thus preventing forced entry.
17. Levers to be operated with a roller bearing spindle hub mechanism.
18. Heavy duty mortise locksets with dead latches are preferred. Inside trim shall include a turn lever to permit egress when door is locked.

C. Exit Devices

1. Electrified exit devices will be Von Duprin, 98/99 Series Rim Device.
2. All exterior doors to be electrified and monitored by the BASIS system and software. Refer to owners Facility Standards.
3. All electrified doors to be installed as night function, so no manual locking is required after hours.
4. All lock hardware must accept BEST Access System, 7 pin, interchangeable cores. Submit lock options to Architect for approval.
5. At least one exterior door will have a Lenel OnGuard card reader.
6. Provide delayed egress function where indicated.
7. The owner will provide all permanent cylinders for the exit devices. The contractor must test cylinders in the hardware to verify that the lockset is functioning properly.
8. If ADA operator is used on any card access door, the door will have both a swipe reader and proximity reader to be tied into Lenel OnGuard.

D. Push/Pulls.

1. Assa Abloy Rockwood www.rockwoodmfg.com

E. Closers.

1. Exterior Closers. – LCN 4041 Series (No Substitutions Allowed).
2. Interior Closers. – LCN 1461 Series (No Substitutions Allowed).
 - a. All closers must be barrier free.
 - b. All closers must have ten (10) year warranty.
 - c. Furnish heavy duty arms "CLP", where noted herein.
 - d. Furnish drop brackets if required.
 - e. Furnish parallel arms on out-swinging doors.

- f. All closers to be furnished with TBWMS screws.
 - g. All closers will be mounted on interior side of room.
 - h. All closers will be equipped with "delayed action" feature.
- F. Door Stops: Acceptable manufacturers are Rockwood, Glynn-Johnson and Sargent.
 - 1. Provide wall mounted stops similar to WS01.
 - 2. Floor Stops similar to McKinney FS01.
 - 3. Where swing of a door interferes with another door, provide roller bumpers similar to Rockwood 455 or 456 as required to suit conditions.
 - 4. Furnish door stops for all door leaves.
 - 5. Furnish overhead (oh) holders/stops Rixson 9/10 adjustable series where wall bumpers are not sufficient.
- G. Rubber Silencers: Provide three (3) per single door and one per leaf of double doors.
- H. Astragals: Shall be 600A by NGP or equal by Pemko
- I. Coordinators, Carry Bars and Strikes: Provide coordinators, carry bars and strikes on pairs of doors which have automatic closers and astragals.
- J. Overhead Holders: Shall be Rixson 9/10 Series or Glynn Johnson, ABH.
- K. Manual and Automatic Bolts/ Coordinators.
 - 1. Flush Bolts 555/557
 - 2. Auto Bolts 1800/1900
 - 3. Coordinator 1600 Series
 - 4. DP Strike 570
 - 5. Where through-bolts are used to attach hardware to metal doors, spacer sleeves in doors shall be provided to prevent collapse of the door.
 - 6. Thru-bolt fasteners shall be templated so as not to make contact with the frame assembly.
- L. Thresholds, Weatherstripping, Lightproofing: Pemko, National Guard or Zero.
 - 1. Threshold 896V
 - 2. Sweep 101VA
 - 3. Weatherstrip 5050
 - 4. Drip Cap 16A@ doors without overhang
- M. Protection Plates.
 - 1. Rockwood, McKinney or Glynn-Johnson
 - 2. Plates shall be .050" thickness.
 - a. Kickplates shall be 10 inches by 2" LDW.
 - b. Mop Plates shall be 6 inches by 1" LDW and stainless steel or brass in .050" thickness
 - c. Screws are to be furnished to match protection plate finish.

2.03 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

- A. Provide products that comply with the following.
 - 1. Applicable provisions of Federal, State, and local codes.
 - 2. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
 - 3. Applicable provisions of NFPA 101, Life Safety Code.

4. Fire-Rated Doors: NFPA 80.
5. All Hardware on Fire-Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of the correct characteristics.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.
- C. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.
- D. Mounting heights for hardware from finished floor to center line of hardware item.
 1. For steel frames: Comply with DHI "Recommended Locations for Architectural Hardware for Steel Doors and Frames."
 2. For wood doors: Comply with DHI "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 3. Wood doors: See Section 08 1416.
- E. Install each hardware item on compliance with the manufacturer's instructions and recommendations. Coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in Division 9 Specifications. Do not install surface-mounted items until finishes have been completed on the substrate.
 1. Door closer shall be mounted and adjusted to meet "ADA" barrier free requirements.
- F. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- G. Drill and countersink units which are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

3.03 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 4000.
- B. Provide an Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

- A. Adjust work under provisions of Section 01 7000.
- B. Adjust hardware for smooth operation.
- C. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- D. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or areas, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of the hardware and doors.

- E. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finish during the final adjustment of hardware. A properly identified binder is required at project closeout including all templates, installation instructions, as built, special details and special tools are to be turned over to owner. Refer to owners facility standards.

3.05 PROTECTION

- A. Protect finished Work under provisions of Section 01 7000.
- B. Do not permit adjacent work to damage hardware or finish.
- C. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- D. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finish during the final adjustment of hardware.

3.06 SCHEDULE - Refer to drawings for Hardware Specification Sets.

END OF SECTION

SECTION 08 8000

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass.
- B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers: Sealant and back-up material.
- B. Section 08 1416 - Flush Wood Doors: Glazed doors.
- C. Section 08 4313 - Aluminum-Framed Storefronts.

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.
- C. ASTM C1036 - Standard Specification for Flat Glass ; 2006.
- D. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass ; 2004.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants ; 2010.
- F. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings ; 2009a.
- G. GANA (GM) - GANA Glazing Manual; Glass Association of North America ; 2009.
- H. GANA (SM) - FGMA Sealant Manual; Glass Association of North America ; 2008.

1.04 SUBMITTALS

- A. See Section 01 3000 - 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 6 x 6 inch in size of glass and plastic units, showing coloration and design.
- E. Certificates: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Certificate: Certify that all tempered glass meets or exceeds specified requirements.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Insulating Glass Units: One of each glass size and each glass type.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 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 7800 - Closeout Submittals, for additional warranty requirements.
- B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 GLAZING TYPES

- A. Type IG-1 - Sealed Insulating Glass Units: Vision glazing, low-E.
 - 1. Application(s): Exterior.
 - 2. Substitutions: Refer to Section 01 6000 - Product Requirements.
 - a. Other products of the basis of design manufacturer and products of other manufacturers will be considered provided the overall performance is within the specified range(s) and the overall appearance is not significantly different from that of the specified product.
 - 3. Between-lite space filled with air.
 - 4. Thermal Resistance (U-Value): 0.27 , nominal.
 - 5. Total Solar Heat Gain Coefficient: 0.38 , nominal.
 - 6. Total Visible Light Transmittance: 70 percent.
 - 7. Basis of Design: Oldcastle: www.oldcastlebe.com
 - 8. Outboard Lite: Annealed float glass, 1/4 inch thick , minimum.
 - a. Glass and Coating: PPG Solarban 60 with Low E coating on #2 surface.
 - 9. Inboard Lite: Annealed float glass, 1/4 inch thick , minimum.
 - a. Coating: None.
 - b. Glass: Untinted Clear.
 - 10. Total Thickness: 1 inch.
- B. Type IG-2 - Sealed Insulating Tempered Glass Units: Vision glazing, low-E.
 - 1. Application(s): Exterior.
 - 2. Substitutions: Refer to Section 01 6000 - Product Requirements.
 - a. Other products of the basis of design manufacturer and products of other manufacturers will be considered provided the overall performance is within the specified range(s) and the overall appearance is not significantly different from that of the specified product.
 - 3. Between-lite space filled with air.
 - 4. Thermal Resistance (U-Value): 0.27 , nominal.
 - 5. Total Solar Heat Gain Coefficient: 0.38 , nominal.
 - 6. Total Visible Light Transmittance: 70 percent.
 - 7. Basis of Design: Oldcastle: www.oldcastlebe.com
 - 8. Outboard Lite: Tempered float glass, 1/4 inch thick , minimum.
 - a. Glass and Coating: PPG Solarban 60 with Low E coating on #2 surface.
 - 9. Inboard Lite: Tempered float glass, 1/4 inch thick , minimum.
 - a. Coating: None.
 - b. Glass: Untinted Clear.
 - 10. Total Thickness: 1 inch.

2.02 EXTERIOR GLAZING ASSEMBLIES

- A. Structural Design Criteria: Select type and thickness to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with IBC 2009 code.
 - 1. Use the procedure specified in ASTM E1300 to determine glass type and thickness.

2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
 3. Thicknesses listed are minimum.
- B. Air and Vapor Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier:
1. In conjunction with vapor retarder and joint sealer materials described in other sections.
 2. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

2.03 GLASS MATERIALS

- A. Float Glass Manufacturers:
1. AGC Flat Glass North America, Inc: www.afgglass.com.
 2. Guardian Industries Corp: www.sunguardglass.com.
 3. Pilkington North America Inc: www.pilkington.com/na.
 4. PPG Industries, Inc: www.ppgideascales.com.
 5. Oldcastle: www.oldcastle.com.
 5. Substitutions: Refer to Section 01 6000 - 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. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

2.04 GLAZING COMPOUNDS

- A. Manufacturers:
1. Bostik Inc: www.bostik-us.com.
 2. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
 3. Pecora Corporation: www.pecora.com.
 4. BASF Construction Chemicals-Building Systems: www.buildingsystems.basf.com.
 5. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.05 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: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; 2x2 inch size; black color.
- D. 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 FGMA Sealant Manual.
- E. Install sealant in accordance with manufacturer's instructions.

3.03 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass and adjacent surfaces.

3.04 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste ; do not mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Gypsum sheathing.

1.02 REFERENCE STANDARDS

- A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009.
- B. ASTM C 473 - Standard Test Methods for Physical Testing of Gypsum Panel Products; 2010.
- C. ASTM C 475/C 475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2002 (Reapproved 2007).
- D. ASTM C 645 - Standard Specification for Nonstructural Steel Framing Members; 2009a.
- E. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.
- F. ASTM C 754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2009a.
- G. ASTM C 834 - Standard Specification for Latex Sealants; 2010.
- H. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board; 2008.
- I. ASTM C 919 - Standard Practice for Use of Sealants in Acoustical Applications; 2002.
- J. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007.
- K. ASTM C 1396/C 1396M - Standard Specification for Gypsum Board; 2009a.
- L. ASTM D 1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials; 2006a.
- M. ASTM D 2394 - Standard Methods for Simulated Service Testing of Wood and Wood-Base Finish Flooring; 2005 e1.
- N. ASTM D 4977 - Standard Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion; 2003 (Reapproved 2009).
- O. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.
- P. ASTM E 413 - Classification for Rating Sound Insulation; 2010.
- Q. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2010.

1.03 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
1. Shop Drawings: Indicate special details associated with acoustic seals.
- C. For Information.
1. Product Data.
- a. Provide data on steel framing, gypsum board, accessories, and joint finishing system.
- b. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.04 QUALITY ASSURANCE

- A. Perform in accordance with ASTM C 840.
1. Maintain one copy of standards at project site.

- B. Applicator Qualifications: Company specializing in performing work of this section with minimum 3 years of documented experience.
- C. Manufacturer's letters of conformance certifying that components to be used on project conform to specified requirements.
 - 1. Sound-rated partitions.
- D. Manufacturer's letters of conformance certifying gypsum board components to be used on project are manufactured in their totality in the continental United States. Materials manufactured outside the continental United States are not acceptable.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Gypsum Board:
 - 1. CertainTeed Corporation: www.certainteed.com.
 - 2. G-P Gypsum Corporation: www.gp.com.
 - 3. Lafarge North America: www.lafargenorthamerica.com.
 - 4. National Gypsum Company: www.nationalgypsum.com.
 - 5. USG Corporation: www.usg.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Steel Framing, Connectors and Accessories:
 - 1. ClarkWestern Building Systems: www.clarkwestern.com.
 - 2. Dietrich Metal Framing, Inc.: www.dietrichindustries.com.
 - 3. Marino-Ware: www.marinoware.com.
 - 4. The Steel Network Inc.: www.SteelNetwork.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ASSEMBLIES

- A. Steel Framing: Design and install in accordance with ASTM C 475 and International Building Code.
- B. Gypsum Board: Install in accordance with ASTM C 754 and International Building Code.
- C. When codes and standards are in conflict, more stringent requirements shall govern.
- D. Acoustic Attenuation for Interior Partitions Indicated as Acoustic: STC as indicated on drawings, calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

2.03 MATERIALS

- A. Steel Framing
 - 1. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 for spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf. For framing supporting abuse-resistant board, select framing size and properties to comply with ASTM C 1629 for level of abuse resistance specified below.
 - a. Studs: 20 gauge C shaped with knurled faces.
 - b. Runners: 20 gauge U shaped, sized to match studs.
 - c. Ceiling Channels: 20 gauge C shaped.
 - d. Furring: 20 gauge hat-shaped sections, minimum depth of 7/8 inch.
 - 2. Ceiling Hangers: Type and size as specified in ASTM C 754 for spacing required.
 - 3. Partition Head To Structure Connections (non-fire rated): Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.
 - 4. Fasteners to concrete
 - a. At floor: Accepted stub nails or 3/16 inch Buildex Tapcon anchors.
 - b. At overhead construction: Tapcon anchors.
 - 5. Fasteners to steel

- a. At steel framing, ceilings, and similar overhead construction: 3/16 inch bolts, toggle bolts, or No. 12 screws as required by conditions.
- B. Gypsum Board Regular.
 - 1. General
 - a. In accordance with ASTM C 1396/C 1396M.
 - b. Manufactured Location: Continental United States.
 - c. Lengths: To minimize joints in place.
 - d. Ends: Square cut.
 - 2. Regular (GBR-R).
 - a. Core: Regular.
 - b. Thickness: 5/8 inch.
 - c. Edges: Tapered.
 - 3. Moisture-Resistant (GBR-M).
 - a. Core: Treated to withstand effects of moisture and high humidity.
 - b. Facing: Light green and treated to withstand effects of moisture and high humidity.
 - c. Thickness: 5/8 inch.
 - d. Edges: Tapered.
 - 4. Interior Ceiling (GBR-I).
 - a. Core: Formulated for sag resistance in accordance with ASTM C 473 equal to 5/8 inch board.
 - b. Thickness: 1/2 inch
 - c. Edges: Tapered.
- C. Gypsum Board Fire Rated.
 - 1. General
 - a. In accordance with ASTM C 1396/C1396M.
 - b. Manufactured Location: Continental United States.
 - c. Rating: By Underwriters Laboratories or Warnock Hersey.
 - d. Lengths: To minimize joints in place.
 - e. Ends: Square cut.
 - 2. Regular (GBF-R)
 - a. Core: Type X or G, as required for fire-rating.
 - b. Thickness: 5/8 inch.
 - c. Edges: Tapered.
- D. Acoustic Insulation (sound attenuation blanket - SAB).
 - 1. In accordance with ASTM C 665.
 - 2. Provide a minimum STC rating of 49.
 - 3. Material: Preformed glass fiber or mineral wool.
 - 4. Type: Unfaced, friction fit.
 - 5. At non-fire-rated partitions extending above ceiling line.
 - a. Thickness: 3-1/2 inches to meet sound rating requirements.
 - 6. At partitions to underside of ceiling.
 - a. Thickness: 3-1/2 inches.
- E. Acoustic Sealant.
 - 1. In accordance with ASTM C 919.
 - 2. Non-hardening, permanently flexible.
 - 3. Gun or spray grade.
 - 4. Acceptable products.
 - a. Pecora Corporation; AIS-919: Harleysville, Pennsylvania 19438 www.pecora.com .
 - b. Tremco, Inc.; TREMstop Smoke & Sound Sealant: Cleveland, Ohio 44104 www.tremcosealants.com.
 - c. United States Gypsum Company; Sheetrock Acoustical Sealant: Chicago, Illinois 60680 www.usg.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

- F. Smoke Control Sealant.
 - 1. In accordance with ASTM C 834.
 - 2. Acrylic latex.
 - 3. Acceptable products.
 - a. Pecora Corporation; AC-20: Harleysville, Pennsylvania 19438 www.pecora.com.
 - b. Tremco, Inc.; TREMstop Smoke & Sound Sealant: Cleveland, Ohio 44104 www.tremcosealants.com.
 - c. Sonneborn a division of BASF Construction Chemicals, Inc.; Sonolac: Shakopee, Minnesota 55379 www.buildingsystems.basf.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- G. Corner Beads: Galvanized steel with perforated flanges, CB bead, as defined in ASTM C 840.
- H. Edge Trim: Bead type(s) as detailed.
- I. Control Joints: Galvanized steel.
- J. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.
- K. Screws: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.
- L. 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. General.
 - 1. Erect plumb and true, without waves or buckles, and rigid.
 - 2. Securely fasten members together and to structural supports.
 - 3. Do not support framing from metal roof deck, air ducts, or piping.
 - 4. Comply with ASTM C 754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members not more than 16 inches on center.
 - 1. Level ceiling system to a tolerance of 1/1200.
 - 2. Laterally brace entire suspension system.
- C. Steel Studs
 - 1. Spacing: As indicated on drawings.
 - 2. Extend partition framing to structure above where indicated and to ceiling in other locations. Anchor to structure above.
 - 3. Use maximum length studs.
 - 4. Install studs vertically in runs of partitions and at partition intersections, partition terminals, and intersections with structural members and walls.
 - 5. Position studs with open side facing in same direction and punch-outs aligned.
 - 6. At framed openings, partition intersections and corners, securely fasten studs to floor runners with screws or similar accepted method.
 - 7. At adjacent vertical metal, concrete, and masonry construction, adhere gasket material to stud and set to compress gasket material approximately 25 percent.
 - 8. Runners: Attach at each end and at not more than 24 inches on centers.
 - 9. Do not terminate partitions at ceiling grid without prior approval by owner and architect: If approval is provided, trim top edge of gypsum board partition with ceiling system "L" trim in white finish.

10. Partitions Terminating at Structure (non-fire rated): Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
 11. Partitions Terminating 4 inches above Ceiling: Extend framing as specified on drawings for partitions extending to underside of construction above.
 12. Partitions Terminating at Underside of Gypsum Board Ceiling.
 - a. Adhere gasket material to top side of ceiling runner.
 - b. Attach ceiling runner through gypsum board at 24 inches on center using hollow wall screw anchors.
- D. At door and similar framed openings.
1. At jambs.
 - a. Use 1-piece full height double studs.
 - b. Screw or bolt together at 24 inch centers.
 - c. Use not less than 0.031 inch thick (20 gauge) components.
 - d. Screw attach jamb studs to frame anchors installed on frames.
 2. At head.
 - a. Form head runner from runner channel 6 inches longer than frame.
 - b. Slit flanges and bend web to allow flanges to overlap vertical jamb studs.
 - c. Anchor head runner flanges to vertical jamb studs.
 - d. Attach 6 inch length of stud perpendicular at each end.
 - e. Securely attach length of stud to jamb studs.
 - f. At center of door but not less than 16 inches on center, attach cripple studs extending from head runner to top of partition.
- E. Chase partition framing.
1. Space floor runner parallel to adjacent partition to form chase and attach.
 2. Position studs in runners vertically spaced to align with studs of adjacent partition and with flanges in same orientation.
 3. Anchor studs to floor runner flanges.
 4. Cross brace between rows of studs.
 - a. Use not less than 2-1/2 inch studs.
 - b. Space at top and at not more than 48 inches on center.
 - c. Anchor web at each end of brace to stud web with 2 panhead screws.
 - d. If chase partition studs are not opposite, install horizontal stud between studs to receive cross brace.
 5. Option, anchor ceiling runner to deck above and use full height studs.
- F. Curved partition framing.
1. Cut 1 leg and web of top and bottom runner at 2 inch intervals for length of arc, allowing 12 inches of uncut runner at each end.
 2. Bend runners to uniform curve of required radius.
 3. Support cut leg of runner by clinching a 1 inch by 22 gauge steel strip to inside of leg.
 4. Attach runners to structural elements at floor and ceiling.
 5. Position studs vertically with open side facing in same direction and engaging floor and ceiling runners.
 6. Space studs equally at:
 - a. 6 inches on centers for arcs between 2 feet and 3 feet.
 - b. 8 inches on centers for arcs between 3 feet and 4 feet.
 - c. 12 inches on centers for arcs between 4 and 5 feet.
 7. Begin and end arc with 2 studs at 6 inches on centers at tangents.
 8. Secure studs to runners.
- G. Control joints.
1. Frame for partition and ceiling control joints.
 2. Locate in accordance with ASTM C 840.
 3. Install framing members on each side of control joint to allow independent movement.

- H. Conventional soffit framing.
1. Attach runner at 24 inches on center to structure above with expansion or adhesive anchors and to suspended ceilings with toggle or molly bolts.
 2. Locate fasteners close to outside face runner.
 3. Attach sidewall runner to stud partitions with screw fasteners to engage each stud and to concrete and masonry with expansion or adhesive anchors at 24 inches on center.
 4. Fasten vertical gypsum board panel to face web of corner runner and flange of ceiling runner with 1 inch screws spaced 12 inches on center located not less than 1 inch from edge of gypsum.
 5. Reinforce vertical gypsum board panels with depth over 2 feet using vertical studs attached to ceiling runner and corner runner.
 6. For spans up to 6 feet, between corner runner and sidewall runner, insert 2-1/2 inch studs and attach to runners.
 7. Attach horizontal gypsum board panel to studs and runners with 1 inch screws spaced 12 inches on center.
- I. Conventional ceiling framing.
1. Space carrying channels at 42 inches on center, beginning and ending within 6 inches of partitions but not penetrating or touching abutting partitions.
 2. Suspend carrying channels from construction above with hanger wires spaced 48 inches on center.
 3. Cross-fur carrying channels with furring channels at 16 inches on center and within 6 inches of partitions.
 4. Securely clip or saddle tie furring channels with 2 strands of 18 gauge wire to carrying channels.
 5. End splice furring channels by nesting 8 inches and secure with wire.
 6. Furnish 1 inch clearance between furring ends and abutting partitions and partitions.
 7. Furnish proper support for gypsum board at partitions which penetrate ceiling plane.
 8. Frame or fur vertical surfaces between different ceiling levels to furnish proper support for gypsum board.
 9. Install additional cross reinforcing to maintain lateral stability at light troffers and openings that interrupt carrying or furring channels.
- J. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
1. Orientation: Horizontal.
 2. Spacing: At 16 inches on center.
- K. Blocking: Install blocking for support of plumbing fixtures. Comply with Section 06 1000 for wood blocking. Provide wood blocking as necessary for partition stability.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Insulation (sound attenuation blankets - SAB).
1. In accordance with GA 600.
 2. In non-fire-rated partitions: Install between partition studs.
 3. In fire-rated partitions: Install mineral fiber batts to completely fill stud cavity.
 4. Install immediately ahead of gypsum board and after one side is complete.
 5. Butt ends of blankets closely and fill voids.
 6. At partitions to underside of ceiling.
 - a. Install sound attenuation blanket over top of ceiling.
 - b. Extend 2 feet on both sides of partition.
 - c. Lay blankets tight for continuous fit.

- C. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place one bead continuously on substrate before installation of perimeter framing members.
 - 2. Place continuous bead at perimeter of each layer of gypsum board.
 - 3. In non-fire-rated construction, seal around all penetrations including but not limited to conduit, pipe, ducts, and rough-in boxes.

3.04 GYPSUM 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. Stagger joints on opposite sides of partitions.
- B. Unless otherwise indicated on Drawings as terminating at finished ceiling, or 4 inches above finished ceiling, extend partitions to overhead construction and face with board on both sides of studs.
- C. Cut to fit neatly around outlets and switch boxes.
- D. Carefully scribe to perimeter construction.
- E. Single-Layer Non-Rated: Install gypsum board vertically, with ends and edges occurring over firm bearing.
 - 1. Gypsum board shall not touch the floor. Clearance shall be no greater than ½ inch.
- F. Gypsum Soffit Board: Install perpendicular to supports, with staggered end joints over supports.
- G. Soffit Construction.
 - 1. Install gypsum board with long dimension at right angles to furring channels.
 - 2. Fasten with screws spaced 12 inches on center in field along abutting edges.
 - 3. Position abutting end joints over web surface of furring channel and fit neatly and accurately with end joints staggered.
 - 4. Support board around cutouts and openings.
- H. Installation on Metal Framing: Use screws for attachment of gypsum board.
- I. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-216.
- J. Curved Partitions:
 - 1. Moisten board by applying clean water to entire face and back surfaces.
 - 2. Stack board on flat surface and let stand for at least 1 hour.
 - 3. Apply board to curved surface.
 - 4. Fasten starting edge.
 - 5. Gradually push board tightly against framing and then fasten.
 - 6. Start from fixed end to free end.
 - 7. Screw to studs in accordance with requirements of ASTM C 840.
 - 8. Use multiple layers of thinner board to achieve required radius and material thickness.
- K. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and tile backer board with sealant.
- L. Ceiling construction.
 - 1. Install gypsum board with long dimension at right angles to furring channels.
 - 2. Fasten with screws spaced 12 inches on center in field and along abutting edges.
 - 3. Position abutting end joints over web surface of furring channel and fit neatly and accurately with end joints staggered.
 - 4. Support board around cutouts and openings.

3.05 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 other locations: As indicated on Drawings.
- 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.

- D. Smoke Control Sealant.
 - 1. Install to seal against passage of smoke.
 - a. At floors, walls, and overhead joints.
 - b. At cutouts for mechanical and electrical outlets.
 - c. At similar smoke leakage points.
- E. Reveal Trim.
 - 1. Install in as long lengths as possible.
 - 2. Carefully align butt joints.
 - 3. Accurately miter inside and outside corners.
 - 4. Tape and treat flanges with filling treatment.

3.06 JOINT TREATMENT

- A. Finish gypsum board in scheduled areas in accordance with levels defined in ASTM C 840 and as scheduled below.
- B. Fill and finish joints and corners of cementitious backing board.

3.07 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.08 FINISH LEVEL SCHEDULE

- A. In accordance with GA -214.
- B. Finishing.
 - 1. Smooth tool marks and ridges by lightly sanding or wiping joint compound with a dampened sponge.
 - 2. Exercise care to ensure that nap of gypsum board facing paper is not raised during sanding operations.
- C. Level 4.
 - 1. Embed tape in joint compound at joints and interior angles.
 - 2. Apply 3 separate coats of joint compound over joints, angles, fastener heads, and accessories.
 - 3. Remove excess joint compound from surfaces.
 - 4. Smooth joint compound free of tool marks and ridges.
 - 5. Locations.
 - a. Walls and ceilings scheduled to receive flat or eggshell paint finish.
- D. Level 5 – all high traffic areas.
 - 1. Embed tape in joint compound at joints and interior angles.
 - 2. Apply 3 separate coats of joint compound over joints, angles, fastener heads, and accessories.
 - 3. Remove excess joint compound from surfaces.
 - 4. Apply thin skim coat of joint compound or material manufactured especially for this purpose to entire surface.
 - a. Smooth skim coat free of tool marks and ridges.
 - 5. Locations.
 - a. Walls and ceilings scheduled to receive semi-gloss or gloss paint finish.

END OF SECTION

SECTION 09 5113
ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 01 4100 - Regulatory Requirements - Seismic Control.

1.02 REFERENCE STANDARDS

- A. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- B. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- C. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- D. ASTM C 423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2007a.
- E. ASTM C 635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2007.
- F. ASTM C 636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2008.
- G. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- H. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.
- I. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material.
- J. ASTM E 413 - Classification for Rating Sound Insulation; 2004.
- K. ASTM E 795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2005.
- L. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems.
- M. ASTM E 1264 - Standard Classification for Acoustical Ceiling Products; 2008.
- N. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.
- O. ASTM E 1477 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
- P. FEDERAL SPEC SS-S-118B – current edition.
- Q. Cisca (AC) - Acoustical Ceilings: Use and Practice; 1999.
- R. NFPA 701 - Standard Methods of Fire Tests for Flame-Resistant Textiles and Films; 2004.
- S. UL (FRD) - Fire Resistance Directory; current edition.
- T. ASHRAE standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality."

1.03 SYSTEM DESCRIPTION

- A. Suspension Systems - General
 - 1. In accordance with requirements of ASTM C 635 with the following modifications.
 - a. Section 7.1: When items not meeting Specifications are discovered, items shall be marked and removed from site immediately.
 - b. Section 13.2: Contractor shall be responsible to see that applied ceiling loads do not exceed load recommendations published by suspension systems manufacturer.
 - c. Install hangers and framing necessary to reduce spans and applied loads to recommendations.

2. Maximum deflection of a spanning component shall not exceed span/360.
3. Duty Rating of suspension system shall be classified in compliance with ASTM C 635.
4. Except where otherwise specified in Contract Documents, suspension systems shall be classified heavy-duty.

1.04 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Information.
 1. Product data.
 - a. Acoustical panel.
 - b. Suspension system duty classification.
 2. Performance data.
 - a. Manufacturer's load rating for each anchoring device.
 3. Certificates.
 - a. Fire hazard classification.
 4. Samples.
 - a. Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and cross tees.
- C. Shop Drawings.
 1. Layout and details of acoustical ceilings. Show locations of items which are to be coordinated with, or supported by the ceilings.
- C. For Closeout.
 1. Certificates.
 - a. Fire hazard classification data.
- D. Maintenance Materials: Furnish following for Owner's use in maintenance of project.
 1. Upon completion of Work, deliver to Owner extra tile in full cartons equal to not less than 5 percent of installed area of each size, pattern, and color used on project.
 2. Furnish in original boxes, properly labeled.
- E. Fire Hazard Classification Data.
 1. Submit certifications for interior materials attesting to compliance with specified fire/smoke ratings.
 2. Notarized affidavits shall state.
 - a. Name of product, name of nationally recognized testing laboratory, laboratory test number, date and test results.
 - b. Product is installed as tested.
 - c. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.05 QUALITY ASSURANCE

- A. Quality control provisions of Division 01, General Requirements, apply to this Section.
- B. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.
- C. Fire Hazard Classification.
 1. Materials tested in accordance with ASTM E 84 to meet fire hazard classification.
 - a. Interior finish and trim.
 - 1) Class A: Flame spread, 0 to 25.
 - 2) Smoke developed, 0 to 450.

- D. Regulatory Requirements.
 - 1. Refer to Section 01 4100 – Regulatory Requirements - Seismic Control, for anchorage of acoustical panel ceilings.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.
- B. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- C. Before installing acoustical ceiling units, permit them to reach room temperature and stabilized moisture content. Refer to manufacturer's directions for product requirements.
- D. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.07 WARRANTY

- A. One (1) year from date of Substantial Completion.
- B. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:
 - 1. Acoustical Panels: Sagging and warping as a result of defects in materials or factory workmanship.
 - 2. Grid System: Rusting and manufacturer's defects
 - 3. Acoustical Panels with BioBlock Plus or designated as inherently resistive to the growth of micro-organisms installed with Armstrong suspension systems: Visible sag and will resist the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.
 - 4. Warranty Period Humiguard:
 - a. Acoustical panels: Ten (10) years from date of substantial completion.
 - b. Grid: Ten (10) years from date of substantial completion.
 - c. Acoustical panels and grid systems with HumiGuard Plus or HumiGuard Max performance supplied by one source manufacturer is thirty (30) years from date of substantial completion.
- C. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Suspension Systems.
 - 1. In accordance with requirements of ASTM C 635 with following modifications.
 - a. Section 7.1: When items not meeting Specifications are discovered, items shall be marked and removed from site immediately.
 - b. Section 13.2: Contractor shall be responsible to see that applied ceiling loads do not exceed load recommendations published by suspension system manufacturer
 - c. Install hangers and framing necessary to reduce spans and applied loads to recommendations.
 - 2. Maximum deflection of any spanning component shall not exceed span/360.
 - 3. Duty rating of suspension system shall be classified in compliance with ASTM C 635.
 - 4. Except where otherwise specified in Contract Documents, suspension systems shall be classified heavy-duty.
- B. Exposed Suspension Grid System.
 - 1. Die cut and interlocking components, with concealed hold-down clips, splices, and perimeter moldings as required.

2. Perimeter moldings.
 - a. Same material and finish as main and cross runners.
 - b. L-shaped molding for mounting at same elevation as face of grid.
 - c. Gasket: Closed cell rubber sponge tape.
 3. Formed steel, commercial quality cold rolled; heavy-duty.
 - a. Profile: Tee; 15/16 inch wide face.
 - b. Acceptable Product: Prelude XL 15/16" Exposed Tee as manufactured by Armstrong World Industries, Inc. Color as scheduled on drawings.
 - c. Construction: Double web.
 - d. Exposed surface finish of flush grid components: Low sheen white.
 - e. Structural Classification: ASTM C 635 HD.
 - f. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.
 - g. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least three times design load, but not less than 12 gauge.
 - h. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.
- C. Mineral Acoustic Panels.
1. Noncombustible Class 25.
 2. Factory applied, standard white washable paint finish.
 3. Surface Texture: Fine
 4. Composition: Mineral Fiber
 5. Size: 24in X 24in X 3/4in
 6. Edge Profile: Angled Tegular for interface with Prelude XL 15/16" Exposed Tee.
 7. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton, 0.70.
 8. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton, 35
 9. Emissions Testing: Section 01350 Protocol, < 13.5 ppb of formaldehyde when used under typical conditions required by ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"
 10. Flame Spread: ASTM E 1264; Class A (UL)
 11. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.86.
 12. Dimensional Stability: HumiGuard Plus - Temperature is between 32°F (0° C) and 120°F (49° C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc) must be complete and dry.
 13. Antimicrobial Protection: BioBlock Plus - Resistance against the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.
 14. Trim Channel –w/ Electrogalvanized Steel.
 - a. Armstrong: www.armstrong.com Lancaster, PA 17604, Axiom Trim Channel: size as specified on Interior Finish Schedule, wide face with 3/4 inch horizontal legs, straight sections with special bosses formed for attachment to the Axiom tee-bar connection clip or hanging clip, corner sections, corner post and accessories commercial quality, extruded aluminum, factory-finished in low sheen white paint.
 15. Acceptable Products: Acoustical panel ceiling – (standard)
 - a. Armstrong Beveled Tegular Cirrus, #584 (Class A).
 - b. Celotex Bevel Edge Cashmere, #CMB-124 (Class A) - #PCMB-124 (FR).
 - c. USG Acoustone Frost Bevel Edge, #419 (Class A) - #406 (FR).
 - d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General.
 - 1. Install acoustical panel ceilings to comply with publications referenced below in accordance with manufacturer's instructions and CISCA Ceiling Systems Handbook.
 - a. Standard for Ceiling Suspension System Installations, in accordance with ASTM C 636.
- B. Suspension System.
 - 1. Hanger wires.
 - a. Secure to structure above only.
 - b. Do not secure hangers to.
 - 1) Metal roof deck.
 - 2) Mechanical components, such as ducts, pipes, accessories.
 - 3) Electrical components, such as conduit, accessories.
 - 4) Electrical raceways in cellular floor systems.
 - 5) Walls or partition framing.
 - c. Do not extend through ducts or to cause interference with runs of ducts.
 - d. Use hanger attachment devices.
 - e. Space 4 feet on centers for carrying channels or main runners.
 - f. Space at perimeters of suspension systems no greater than 6 inches from grid edge.
 - g. Install plumb.
 - h. Do not press against insulation covering ducts or pipes.
 - i. Brace or counter-splay to offset horizontal force of splayed hangers.
 - j. In systems where hanger wires are secured to special attachment devices supporting carrying channels or main runners, attachment devices shall have certified load test data from independent test laboratory and be capable of carrying 5 times design load.
 - 2. Main runners.
 - a. Interlock to form sturdy, level, square-angled ceiling grid.
 - b. Install to level within 1/8 inch in 10 feet.
 - c. Determine levelness from measurements taken below hanger points.
 - 1) Take measurements after completion of ceiling installations but prior to building occupancy.
 - 2) Perform leveling with supporting hanger taut to prevent subsequent downward movement when ceiling loads are imposed.
 - 3) Do not kink or bend hanger wires as means of leveling.
 - d. Tightly wrap and sharply bend wire loops to prevent vertical movement or rotation of member within loops.
 - e. Joint connection shall align exposed surfaces within vertical and horizontal distance of 0.015 inch.
 - 3. Cross runners.
 - a. Install to within 1/32 inch of required center distances, noncumulative beyond 12 feet.
 - b. Form right angles with main runners.
 - c. Exposed surfaces of 2 intersecting runners shall lie within vertical distance of 0.015 inch of each other with cross member always above main member.
 - 4. Perimeter moldings.
 - a. Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - b. Install continuous gasket.
 - c. Use longest practical lengths.
 - d. Overlap and rivet corners.
 - e. Where round obstructions and bullnose concrete masonry occur, provide preformed closures to match perimeter molding.

5. Assembly devices shall limit horizontal gaps between exposed surfaces of abutting or intersecting members to not more than 0.020 inch.
 6. Spring wire clips used for supporting main runners shall maintain tight contact between main runners and carrying channels when ceiling loads are imposed on runners.
 7. Fixtures.
 - a. Prepare suspension system to accept fixtures without compromising ceiling performance.
 - b. If fixture dead load causes support runners to exceed allowable deflection of suspension system, install supplemental hangers within 6 inches of each fixture corner.
 - c. Runners supporting ceiling fixtures shall not rotate more than 2 degrees after fixture loads are imposed.
 - d. If fixture installation produces rotation of runners in excess of 2 degrees, furnish and install suitable accessory devices to symmetrically support fixture on runners.
 - e. Review Contract Documents for number, size, spacing, location, and types of fixtures to be accommodated in or above ceiling.
 - f. Exclude from this Section lighting fixtures and securement of lighting fixtures to suspension system.
 8. Coordination.
 - a. Prior to beginning acoustical ceiling construction, designate areas of potential interference between ceiling components and components from other contractors.
 - b. Communicate with other contractors to achieve coordinated installation.
 - c. Report areas of interference that arise following beginning of ceiling construction to Architect's Field Representative as soon as interference is observed.
 9. Include additional carrying channels, sheet metal, metal furring, and construction necessary to incorporate components shown on drawings, including drapery tracks and closures.
 10. Where steel beams are indicated to be fireproofed, coordinate construction to result in correct fireproofing and ceiling installation without additional cost to Owner.
- C. Acoustic Ceiling Panels.
1. Fit accurately into suspension system.
 2. Scribe and cut panels at borders and penetrations with neat and precise fit.
 3. Install with undamaged edges.
 4. Arrange directionally patterned panels with pattern running in parallel to long axis of room.
 5. For square edge panels, install with edges fully hidden by flanges of runners and moldings.
 6. For reveal edge panels, install with bottom of reveal in full contact with top surface of runner flanges.
 7. Paint exposed cut edges to match panel face.
 8. Touch up acoustic ceiling to leave in neat, first-class condition, free from defects.
 9. Acoustic Ceiling Panels shall not be installed until all work above ceiling has been completed and temperature and humidity will be maintained as indicated for final occupancy.

END OF SECTION

**SECTION 09 6500
RESILIENT FLOORING**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 03 5400 - Cast Underlayment.

1.02 REFERENCE STANDARDS

- A. ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2008.
- B. ASTM F 150 - Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring; 2006.
- C. ASTM F 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2008.
- D. ASTM F 1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing; 2004.
- E. ASTM F 1861 - Standard Specification for Resilient Wall Base; 2002.
- F. ASTM F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2004.
- G. ASTM F 2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes; 2002.
- H. RFCI WP - Recommended Work Practices for the Removal of Resilient Floor Coverings; 1998.
- I. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.03 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Samples for verification.
 - a. Each tile color.
 - b. Each sheet flooring color.
 - c. Base: 6 inches long, each type.
 - d. Submit two samples 12 inches by 12 inches in size illustrating color and pattern for each resilient flooring product specified.
 - 2. Shop Drawings.
 - a. Indicate seaming plan and floor pattern layouts.
 - 3. Product Data.
 - a. Provide data on specified products, describing physical and performance characteristics, including sizes, patterns and colors available and installation instructions.
 - 4. Maintenance Data.
 - a. Include maintenance procedures, recommended maintenance materials and suggested schedule for cleaning, stripping and re-waxing.
 - b. Upon completion of work, deliver to Owner additional 1 percent quantity of each type and color of carpet tile used in scope of work.
 - c. Label stock with style, pattern, dye lot in addition to manufacturer's label.
- C. For Information.
 - 1. Product data.
 - a. Each flooring type.
 - b. Each required item.

2. Certificates.
 - a. Silicone-free.
 - b. Fire hazard classification data.
3. Manufacturer's instructions.
 - a. Installation of each material.
- D. For Closeout.
 1. Certificates.
 - a. Silicone-free.
 - b. Fire hazard classification data.
 2. Maintenance data.
 - a. For each material.
- E. Fire Hazard Classification Data.
 1. Submit certifications for interior materials attesting to compliance with specified fire/smoke ratings.
 2. Notarized affidavits shall state.
 - a. Name of product, name of nationally recognized testing laboratory, laboratory test number, date and test results.
 - b. Product is installed as tested.
- F. Silicones.
 1. Materials and equipment for this Project: Silicone-free.
 2. Factory installed or field applied lubricants, sealants, coatings, and gasketing, containing silicones are prohibited.
 3. Submit written certification that materials and equipment installed or consumed in construction are free from traces of silicone.

1.04 QUALITY ASSURANCE

- A. Fire Hazard Classification Data.
 1. Materials tested to meet fire hazard classification.
 - a. Critical radiant flux: 0.45 watts per square centimeter or greater, in accordance with ASTM E 648.
- B. Installer Qualifications.
 1. For moisture control coating: Factory trained Ardex LevelMaster Elite Installer with not less than three years documented experience in installing Ardex Moisture Control System.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

1.06 FIELD CONDITIONS

- A. Temperature in areas of installation shall be at least 65 degrees F for 48 hours prior to, during, and 48 hours after installation.

1.07 WARRANTY

- A. All products meet AU Interior Finish Standards.
- B. Warranted against manufacturing defects and installation integrity for five years.
- C. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Resilient Flooring and Base.
 1. Flexco Company, Tuscumbia, Alabama 35674: www.flexcofloors.com.
 1. Armstrong Commercial Flooring, Lancaster, PA, www.armstrong.com
 2. Johnsonite Division, Duramax, Inc., Chagrin Falls, Ohio 44023: www.johnsonite.com.

3. Mannington Commercial, Calhoun, Georgia 30701: www.mannington.com (as scheduled).
 4. Roppe Rubber Corporation, Fostoria, Ohio 44830: www.roppe.com.
 5. Centiva,
- Substitutions: See Section 01 6000 - Product Requirements.

B. Molding Accessories.

1. Flexco Company, Tuscumbia, Alabama 35674: www.flexcofloors.com.
1. Armstrong Commercial Flooring, Lancaster, PA, www.armstrong.com
2. Johnsonite Division, Duramax, Inc., Chagrin Falls, Ohio 44023: www.johnsonite.com.
3. Mannington Commercial, Calhoun, Georgia 30701: www.mannington.com.
4. Roppe Rubber Company, Fostoria, Ohio 44830: www.roppe.com (as scheduled).
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Cast underlayment, in accordance with Section 03 5400.

B. Resilient Tile (VCT-1, 2, 3).

1. Material: Vinyl composition tile, homogeneous, with through-pattern color extending throughout thickness and in accordance with ASTM F 1066 of class corresponding to type specified.
2. Thickness: 1/8 to 5/32 (0.120 to 0.179) inch.
3. Size: 12 by 12 inches.
4. Pattern: Through-pattern directional.
5. Installation: Quarter turned (grain perpendicular to adjacent tiles)
6. Recycled Content: Contains a min of 2% post-consumer Recycled Content.
7. Indoor Air Quality: Meets SCS Certification for FloorScore Indoor Air quality or equal.
8. Gloss value: 60 degrees specular: 20-40.
9. Static Load limit of 75 lbs./ sq. in.
10. Meets ASTM E 648 and 662.
11. Acceptable product: Refer to Finish Schedule.

D. Adhesives and similar application materials as recommended by flooring manufacturer.

1. VOC Content of Interior Adhesives: Provide interior adhesives that comply with following limits for VOC content when calculated according to South Coast Air Quality Management District Rule No.1168:
 - a. VCT flooring adhesive: 50 g/L.
 - b. Cove base adhesives: 50 g/L.
2. Refer to Manufacture requirements for product adhesive.

E. Resilient Base.

1. Resilient Base Coved (RB-1).
 - a. Style: Top-set coved.
 - b. Material: Rubber.
 - c. Height: 4 inches.
 - d. Refer to Finish Schedule and Finish Plans

F. Moisture Control Coating.

1. Two-coat, two-part epoxy coating supplied in pre-measured containers.
2. Designed to reduce moisture emission to less than 3 pounds per square foot of coated slab-on-ground.
3. Acceptable product.
 - a. Ardex Moisture Control System consisting of P-MC Primer and S-MC Sealer by Ardex Engineered Cements: www.ardex.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

- G. Reducer Strips.
 - 1. Acceptable products.
 - a. Schuler Systems; SCHIENE.
 - b. Mannington Commercial, Calhoun, Georgia 30701; www.mannington.com.
 - c. Roppe Rubber Corporation, Fostoria, Ohio 44830: www.roppe.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

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 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 F 710; obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
 - 1. Make appropriate tests to determine that subfloor is dry.
 - a. For installations of resilient flooring over slab on-or-below grade, manufacturer's representative shall perform moisture testing to meet manufacturer's minimum requirements for moisture content prior to installation of flooring.
 - b. In accordance with ASTM F 1869 or F 2170.
 - c. Taped plastic sheeting is not acceptable method.
 - d. Perform moisture emission tests when environmental conditions closely approximating anticipated in-service conditions to avoid false acceptable readings due to lack of vapor drive.
 - 2. Test to determine that pH of subfloor is within adhesive manufacturer's requirements.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Concrete Subfloor.
 - 1. Moisture control coating for slab-on-ground.
 - a. Fill non-moving cracks and joints with epoxy material recommended by moisture control coating manufacturer. Honor moving (expansion and isolation) joints up through moisture control coating and underlayment.
 - b. Verify that surface cleanliness, profile, and moisture emission level comply with moisture control coating manufacturer's written instructions.
 - c. Apply first (primer) coat and allow to dry in accordance with moisture control coating manufacturer's written instructions.
 - d. Apply second (sealer) coat at 90 degrees to direction of first coat and broadcast fine sand (98.5 percent passing No. 35 sieve) while still fresh (typically not more than 30 minutes).
 - e. After second coat is dry (typically not less than 16 hours), broom sweep and vacuum loose sand off surface.
 - f. Protect coated surface prior to application of cementitious underlayment.
 - 2. Thoroughly dry prior to laying resilient flooring without exception.
 - 3. Call to the attention of Architect's Field Representative subfloor not in correct condition to receive resilient flooring.
 - 4. Installation of resilient flooring shall be considered an acceptance of subfloor surface.
 - 5. Broom clean, free from hardening compounds, dust, scale, or similar objectionable matter.
 - 6. Remove paint, varnish, or oil stains.

7. When in contact with ground, prime with primer recommended by resilient flooring manufacturer before application of adhesive.
8. Install cast underlayment if needed to provide proper substrate for new flooring.
9. No permanent markers are to be used on concrete subfloor by installers due to bleeding and absorption of vinyl products.

3.03 INSTALLATION

- A. Resilient Components.
 1. Use adhesive in accordance with manufacturer's published instructions.
 2. Firmly press into full bed of adhesive with surface even, flush, and neatly fitted at joints.
 3. Lay out to:
 - a. Extend into adjacent spaces, such as closets and recesses
 - b. Extend into recesses and openings.
 - c. Extend under radiation.
 - d. Closely fit around columns, piers, floor grilles, and openings.
 - e. Abut vertical surfaces.
- B. Install Resilient Tile.
 1. Lay out to:
 - a. Use not less than 1/2 tile.
 - b. Use equal size tiles on opposite sides of rooms and corridors.
 - c. Orient directional pattern grain in one direction in each space as determined by Architect's Field Representative.
 - d. Orient directional pattern grain in one direction.
 2. In accordance with manufacturer's standard instructions, unless otherwise specified in Contract Documents.
 3. Apply with epoxy adhesive.
 4. Apply with waterproof adhesive.
 5. With surface even and flush with adjacent tiles.
 6. Free from high or low edges and corners.
 7. With joints in straight lines, parallel or at right angles to principal walls.
 8. With tight joints.
 9. To carry through door openings to form flush thresholds, unless otherwise shown on Drawings.
- C. Resilient Base.
 1. Use pre-molded external corners.
 2. Apply to exposed surfaces of casework, including knee spaces unless otherwise noted on drawing.
 3. Exclude base for exposed surfaces of casework.
 4. Exclude base on wall surfaces concealed by casework.
 5. Stop at intersection where casework abuts walls.
- D. Resilient Molding Accessories.
 1. Use cove cap at edges where flooring turns up wall as integral cove, as edge trim for panels and similar locations shown on drawings.
 2. Use reducer strips at intersections between floorings of different thicknesses.

3.04 CLEANING

- A. Thoroughly clean flooring at completion of installation.
 1. Sweep or vacuum floor thoroughly to remove any loose dirt, dust and other foreign materials.
 2. Refer to manufacturer's instruction on maintenance for a newly installed floor, preparation for commercial use and regular maintenance.

- B. Immediately before turning project over to Owner, seal and wax resilient floors in accordance with printed specification of Hillyard Chemical Company or other approved.
- C. Finish by buffing in accordance with manufacturer's directions to present a burnished gloss appearance.
- D. Surface shall not be slippery.
- E. Treat and finish flooring to non-slippery, low satin gloss.
- F. Do not scrub floor with steel wool pads, wire brushes, aggressive floor cleaners or cleansers. These products can cause severe scratching and damage to the floor surface.

3.05 PROTECTION

- A. Protect floors with building paper until building is ready for occupancy.
- B. Tape joints in building paper.
- C. Furnish and place plywood or hardboard covers over vinyl sheet flooring where traffic or moving of heavy loads might puncture protective sheets.

END OF SECTION

SECTION 09 6813

TILE CARPETING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2008b.
- B. ASTM F 710 -- Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2008
- C. ASTM F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2004.
- D. ASTM F 2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes; 2002.
- E. NFPA 258 - Standard Research Test Method for Determining Smoke Generation of Solid Materials; 2001.
- F. 16 CFR 1630 - Standard for the Surface Flammability of Carpets and Rugs (FF 1-70); current edition.
- G. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.02 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Samples for verification.
 - a. Carpet tiles: full tile (3 samples each type).
 - b. Submit three 12 inch long samples of edge strip.
 - c. Submit data documenting VOC content of carpet tile and adhesives; copy of current CRI Approved Products Listing is acceptable.
- C. For Information.
 - 1. Certificates.
 - a. Fire hazard classification.
- D. Contract Closeout Submittals.
 - 1. Certificates.
 - a. Fire hazard classification.
 - 2. Maintenance data.
 - a. Manufacturer's printed maintenance instructions (3 copies).
- E. Maintenance Materials: Furnish following for Owner's use in maintenance of project including maintenance procedures, recommended maintenance materials and suggested schedule for cleaning.
 - 1. Upon completion of work, deliver to Owner additional 2 percent quantity of each type and color of carpet tile used in scope of work.
 - 2. Label stock with style, pattern, dye lot in addition to manufacturer's label.

1.03 MOCK-UP

- A. Refer to Section 01 4000 - Quality Requirements, for general requirements for mock-up.
- B. Provide carpet installation mock-up of 4 feet long by 4 feet wide, illustrating specified product. Locate in area as directed by contract documents and where directed by owner.
- C. Mock-up may remain as part of work.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum 10 years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet with minimum five years' experience.
- C. Quality control provisions of Division 01, General Requirements, apply to this section. Acceptances, except those required for field installation, field applications, and field tests, shall be obtained before delivery of items of material, equipment or systems to project site.
- D. Fire Hazard Classification Data.
 - 1. Not later than 30 days prior to Contract completion date, submit certifications for interior finish materials attesting to compliance with specified fire/smoke ratings.
 - 2. Notarized affidavits shall state.
 - a. Name of product.
 - b. Name of nationally recognized testing laboratory.
 - c. Laboratory test number, date.
 - d. Test results.
 - e. Product installed as tested.
- E. Fire hazard classifications shall meet or exceed the following as determined in accordance with listed procedures.
 - 1. Timed burning tablet in accordance with CPSC 16 CFR Part 1630: Pass.
 - 2. Smoke density in accordance with NFPA 258: 450 or less.
 - 3. Critical radiant flux in accordance with ASTM E 648: 0.45 watts/sq.cm. or greater for exitways and 0.22 watts/sq.cm. or greater for rooms segregated from exitways.
- F. Samples shall have manufacturer's tag or label attached. Materials installed shall conform to samples accepted by Interior Designer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver carpet tiles items and accessories to site in original unopened containers, or bundles bearing manufacturer's name and brand.
- B. Affix labels to products, containers, or bundles to indicate compliance with requirements for fire hazard classification.
- C. Delivered products, containers, or bundles not having complete labels may be rejected.
- D. Keep materials dry.
- E. Store inside building.
- F. Store materials in area of installation for a minimum period of 24 hours prior to installation.

1.06 WARRANTY

- A. All products meet AU Interior Finish Standards.
- B. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Mohawk: www.mohawk.com as specified.
- B. Interfaceflor, LLC: www.interfaceflor.com.
- C. Lees: Burlington Industries, Inc.: www.lees-carpet.com.
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Carpet Tile (CPT-1).
 - 1. Characteristics.
 - a. Construction: Tufted.
 - b. Pile texture: Leveled Pattern Loop.
 - c. Gauge: 1/12 inch.
 - d. Yarn: Colorstrand® SD Nylon.
 - e. Dye: Solution Dyed.
 - f. Stitches between 10 and 15 per inch.
 - g. Density: Average density = 6,100; weight density = 104,040.
 - h. Pile height between 0.200 and 0.250 inch.
 - i. Yarn weight between 17-30 ounces per square yard.
 - j. Primary backing: EcoFlex ICT.
 - k. Special treatments: Sentry Plus.
 - l. Color: Refer to Finish Schedule.
 - m. Recycled Content: total between 35% - 50%
 - n. Installation: Brick Ashlar.
 - o. Size: refer to finish schedule.
 - 2. Acceptable products.
 - a. Refer to Finish Schedule.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- B. VOC Content of Interior Adhesives: Provide interior adhesives that comply with following limits for VOC content when calculated according to South Coast Air Quality Management District Rule No. 1168:
 - 1. Indoor carpet adhesives: 50 g/L.
- C. Resilient straight (toeless) base is excluded from this Section.
- D. Underlayment.
 - 1. Install mastic type underlayment to build up thickness or to form level and smooth subfloor surface to receive carpet tiles.
 - 2. Composition which can be troweled on and feathered out on edges.
 - 3. Latex or polyvinyl acetate cement and sand composition, or other mastic composition as accepted by Architect.
 - 4. Compatible with adhesive to be used over same.
 - 5. Apply latex type underlayment in single layers not greater than 1/8 inch thickness and not more than 3/8 inch total thickness.
 - 6. Releasable glue system must be used for installation direct glue down system is not acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
- C. Verify that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by carpet tile manufacturer and adhesive materials manufacturer.
 - 1. Make appropriate tests to determine that subfloor is dry.
 - a. For installations of carpet tile flooring over slab on-or-below grade, manufacturer's representative shall perform moisture testing to meet manufacturer's minimum requirements for moisture content prior to installation of flooring.

- b. In accordance with ASTM F 1869 or F 2170.
 - c. Taped plastic sheeting is not acceptable method.
 - d. Perform moisture emission tests when environmental conditions closely approximating anticipated in-service conditions to avoid false acceptable readings due to lack of vapor drive.
- 2. Test to determine that pH of subfloor is within adhesive manufacturer's requirements.
- D. Installation will be considered acceptance of substrate.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Apply cast underlayment to form level and smooth surface, as specified in Section 03 5400.

3.03 INSTALLATION

- A. Take field measurements to determine exact yardage requirements prior to ordering carpet.
- B. Extra compensation will not be made as result of failure to observe or to become familiar with working conditions.
- C. Inspect and prepare subfloor surface prior to installation of carpet tiles.
- D. Subfloor shall be free from foreign material.
- E. Remove subfloor irregularities by underlayment or sanding to prevent unnecessary wear of carpet tiles.
- F. Install carpet tiles with releasable glue system as required by AU Interior Facility Standards. Refer to Manufacturers recommended products with this type system.
- G. Adhesive shall be flame retardant to comply with fire hazard classifications.
- H. Installation technique.
 - 1. Brick, Monolithic.
 - 2. Ashlar.
 - 3. Random.
 - 4. Quarter-turn - walk-off only.
 - 4. Refer to manufactures directions for installation techniques required.
- I. Extend carpet tiles into recesses and door openings, unless otherwise shown.
- J. Upon completion, carpet tiles shall be free from puckers, bubbles, or other fabric distortions.
- K. Seams: Neatly made, closed tight, straight, and in plane of carpet tiles.
- L. Edges: Smooth and even, butted tightly to vertical surfaces, and fitted fully into undercut edge of carpet bars.
- M. Remove cuttings and debris.
- N. Spot clean and vacuum before final acceptance by Owner.

3.04 PROTECTION

- A. Carpet tile installation shall be completely and effectively protected from time of installation until building is turned over to Owner.
- B. Use clean, non-staining, reinforced building paper or reinforced plastic sheets and fasten securely in place.
- C. Do not use protective sheets incorporating asphalt.
- D. Furnish and place plywood or hardboard covers over carpet tiles where traffic or moving of heavy loads might puncture protective sheets.

END OF SECTION

SECTION 09 9100

PAINTING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2010.
- B. ASTM D523 - Standard Test Method for Specular Gloss; 2008.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.
- D. GreenSeal GC-03 - Anti-Corrosive Paints, Second Edition, January 7, 1997.
- E. GreenSeal GS-11 - Architectural Paints; 1993.
- F. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; 2004.
- G. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.
- H. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

1.02 SUBMITTALS

- A. Refer to Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Samples for verification.
 - a. Three paper "drop" samples 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating colors of specified products.
 - b. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
- C. For Information.
 - 1. Product data.
 - a. Provide complete list of products to be used, with following information for each.
 - 1) Manufacturer's name, product name and/or catalog number, and general product category (such as "alkyd enamel").
 - b. Cross reference to specified paint system(s) product is to be used in; include description of each system.
 - 2. Performance data.
 - a. Recommended in-place wet or dry film thicknesses.
 - b. Gloss ratings.
 - c. Paint analysis.
 - d. Technical data.
 - 3. Manufacturer's instructions.
 - a. For preparation.
 - b. For application.
 - 4. Certificates.
 - a. Manufacturer's statement that product comply with Contract Documents and are compatible with substrates and with other products.
 - 5. Maintenance data.
 - a. Cleaning, touch-up, and repair of painted and coated surfaces.
- D. Maintenance Materials: Furnish following for Owner's use in maintenance of project.
 - 1. Supply 1 gallon of each color, type, and surface texture; store where directed.
 - 2. Label each container with color, type, and texture in addition to manufacturer's label.

1.03 MOCK-UP

- A. Refer to Section 01 4000 - Quality Requirements, for general requirements for mock-up.
- B. Provide door and frame assembly illustrating coating color, texture, and finish.
- C. Provide wall finish mock up on wall painted 3 feet long by 3 feet wide, illustrating coating color, texture and finish. Locate where directed by owner.
- D. Mock-up may remain as part of work.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

1.05 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by 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 humidity ranges required by 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. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.06 WARRANTY

- A. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General.
 - 1. Use materials listed under heading, Paint Systems Schedule.
 - 2. To substitute manufacturers and materials other than those specified, submit for acceptance schedule of proposed items in form identical to heading, Paint Systems Schedule.
 - 3. Do not deliver unaccepted materials to site.
 - 4. Provide ready mixed paints and coatings.
 - 5. Provide materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Volatile Organic Compound (VOC) Content.
 - 1. Provide coatings that comply with most stringent requirements specified in following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. USGBC LEED-NC Rating System, Version 2.2, specifically:
 - 1) Opaque topcoats:
 - (a) Flat: 50 g/L, maximum.
 - (b) Nonflat: 150 g/L, maximum.
 - (c) Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
 - 2) Anti-corrosive paints applied to interior ferrous metal substrates:
 - (a) 250 g/L, Green Seal GC-03.
- C. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified; commercial quality.

- D. Patching Material: Latex filler.
- E. Fastener Head Cover Material: Latex filler.
- F. Gloss Criteria.
 - 1. Trade names will not be accepted as gloss level identification.
 - 2. Determine gloss value of paint finish by testing paint samples according to ASTM D523, using 60 degree geometry.
 - 3. Paint samples shall be 4 mils thick and approximately 48 hours old, except that epoxy paints shall be fully cured.
 - 4. Interior finish paint systems gloss values.
 - a. Alkyd, semi-gloss: Between 40 and 60 degrees.
 - b. Alkyd, eggshell: Between 7 and 15 degrees.
 - c. Latex, gloss: Between 60 and 80 degrees.
 - d. Latex, semi-gloss: Between 40 and 60 degrees.
 - e. Latex, eggshell: Between 10 and 20 degrees.
 - f. Epoxy: 65 degrees or greater.
- G. Provide colors as described in Room Finish and Color Schedule.
- H. Workmanship shall be of highest grade.
- I. High traffic areas: corridors and stairwells require a Level 5 finish.

2.02 MANUFACTURERS

- A. Provide paint and coating products from same manufacturer.
- B. In event single manufacturer cannot provide all specified products, minor exceptions shall be permitted, provided approval of Architect is obtained using specified procedures for substitutions.
- C. Acceptable Manufacturers.
 - 1. Devoe: Devoe Coatings, a brand of Akzo Nobel Paints LLC, Strongsville, Ohio 44136: www.devoecoatings.com.
 - 2. Pittsburgh: Pittsburgh Paints, PPG Architectural Finishes, Inc., Pittsburgh, Pennsylvania 15272: www.pittsburghpaints.com.
 - 3. Sherwin-Williams: The Sherwin-Williams Company, Cleveland, Ohio 44101: www.sherwin-williams.com (as specified).
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.03 PAINT SYSTEMS SCHEDULE

- A. Interior Paint Systems.
 - 1. Latex, semigloss.
 - a. Undercoat for wood.
 - 1) Pittsburgh; Speedhide Interior Latex Enamel Undercoater 6-855.
 - 2) Sherwin-Williams; PrepRite Wall & Wood Interior Oil Primer/Undercoater B49W2.
 - b. Undercoat for steel.
 - 1) Devoe; Devflex DTM Flat Interior/Exterior WB Primer & Finish 4020 PF.
 - 2) Pittsburgh; Pitt-Tech Interior/Exterior DTM Primer/Finish 90-712.
 - 3) Sherwin-Williams; DTM Acrylic Primer/Finish B66W1.
 - c. Undercoat for galvanized steel.
 - 1) Devoe; Devflex DTM Flat Interior/Exterior WB Primer & Finish 4020 PF.
 - 2) Pittsburgh; Pitt-Tech Interior/Exterior DTM Primer/Finish 90-712..
 - 3) Sherwin-Williams; Pro Industrial Pro-Cryl Universal Primer B66-310.
 - d. Undercoat for aluminum.
 - 1) Devoe; Devflex DTM Flat Interior/Exterior WB Primer & Finish 4020 PF.
 - 2) Pittsburgh; Pitt-Tech Interior/Exterior DTM Primer/Finish 90-712.
 - 3) Sherwin-Williams; Pro Industrial Pro-Cryl Universal Primer B66-310.
 - e. Undercoat for concrete masonry units.

- 1) Pittsburgh; Speedhide Interior/Exterior Latex Masonry Block Filler 6-7.
 - 2) Sherwin-Williams; Cement-Plex 875, B42W200.
- f. Undercoat for gypsum board.
 - 1) Pittsburgh; Speedhide Interior Q.D. Latex Sealer 6-2.
 - 2) Sherwin-Williams; ProGreen 200 Interior Latex Primer B28W600.
- g. Finish coats (2).
 - 1) Pittsburgh; Speedhide Interior Acrylic Latex Semi-Gloss Enamel 6-510 Series.
 - 2) Sherwin-Williams; MacroPoxy 646-100, B58 Series.
2. Latex, eggshell.
 - a. Undercoat for steel.
 - 1) Devoe; Devflex DTM Flat Interior/Exterior WB Primer & Finish 4020 PF
 - 2) Pittsburgh; Pitt-Tech Interior/Exterior DTM Primer/Finish 90-712.
 - 3) Sherwin-Williams; DTM Acrylic Primer/Finish B66W1.
 - 4) Sherwin-Williams; Pro Industrial Pro-Cryl Universal Primer B66-310.
 - b. Undercoat for galvanized steel.
 - 1) Devoe; Devflex DTM Flat Interior/Exterior WB Primer & Finish 4020 PF
 - 2) Pittsburgh; Speedhide Water Base Inhibitive Metal Primer 6-712.
 - 3) Sherwin-Williams; Galvite HS B50WZ30.
 - 4) Sherwin-Williams; Pro Industrial Pro-Cryl Universal Primer B66-310.
 - c. Undercoat for aluminum.
 - 1) Devoe; Devflex DTM Flat Interior/Exterior WB Primer & Finish 4020 PF
 - 2) Pittsburgh; Pitt-Tech Interior/Exterior DTM Primer/Finish 90-712.
 - 3) Sherwin-Williams; Pro Industrial Pro-Cryl Universal Primer B66-310.
 - d. Undercoat for concrete masonry units.
 - 1) Pittsburgh; Speedhide Interior/Exterior Latex Masonry Block Filler 6-7.
 - 2) Sherwin-Williams; PrepRite Interior/Exterior Latex Block Filler B25W25.
 - e. Undercoat for gypsum board.
 - 1) Pittsburgh; Speedhide Interior Q.D. Latex Sealer 6-2.
 - 2) Sherwin-Williams; ProGreen 200 Interior Latex Primer B28W600.
 - f. Finish coats (2).
 - 1) Pittsburgh; Speedhide Interior Latex Eggshell Enamel 6-411 Series.
 - 2) Sherwin-Williams; ProGreen 200, eggshell, B20-600 series
3. Waterborne dryfall flat.
 - a. Undercoat for steel.
 - 1) Devoe; Devflex DTM Flat Interior/Exterior WB Primer & Finish 4020 PF.
 - 2) Pittsburgh; Pitt-Tech Interior/Exterior DTM Primer/Finish, 90-712.
 - 3) Sherwin-Williams; Kem Kromik Universal Metal Primer B50Z Series.
 - b. Undercoat for galvanized steel.
 - 1) Pittsburgh; Pitt-Tech Interior/Exterior DTM Primer/Finish, 90-712.
 - 2) Sherwin-Williams; Waterborne Acrylic Dryfall B42W1.
 - c. Undercoat for aluminum.
 - 1) Pittsburgh; Pitt-Tech Interior/Exterior DTM Primer/Finish, 90-712.
 - 2) Sherwin-Williams; Waterborne Acrylic Dryfall B42W1.
 - d. Undercoat for masonry.
 - 1) Pittsburgh; Speedhide Interior Q.D. Latex Sealer 6-2.
 - 2) Sherwin-Williams; Waterborne Acrylic Dryfall B42W1.
 - e. Finish coat.
 - 1) Pittsburgh; Speedhide Interior Latex Flat Dry Fog Spray Paint 6-715 Series.
 - 2) Sherwin-Williams; Waterborne Acrylic Dryfall B42W1.

PART 3 EXECUTION

3.01 SCOPE – SURFACES TO BE FINISHED

- A. Paint exposed surfaces except where indicated not to be painted or to remain natural; term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.

- B. Refer to other Sections when figuring this work, to become thoroughly familiar with character, amount, and other conditions of work.
- C. Provide scaffolds and staging required for proper execution of work.
- D. Paint the surfaces described in PART 2, indicated on drawings, and as follows.
 - 1. If surface, material, or item is not specifically mentioned, paint in same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.
 - 2. Paint surfaces behind movable equipment and furnishings same as similar exposed surfaces.
 - 3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of permanent item.
 - 4. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.
 - 5. Paint surfaces that are cut and patched to permit installation of electrical facilities, piping, and ductwork.
 - 6. Finish top, bottom, and side edges of exterior doors same as exposed faces.
 - 7. Paint insulated and exposed pipes occurring in finished areas to match background surfaces, unless otherwise indicated.
 - 8. Paint equipment, piping, conduit, and exposed duct work in utility areas in colors according to color coding scheme indicated.
 - 9. Refer to Section 23 0553 and Section 26 0553 for schedule of color coding of equipment, duct work, piping, and conduit.
 - 10. Paint mechanical and electrical equipment, including that which is factory-finished, exposed to weather or to view on roof and outdoors.
 - 11. Paint shop-primed mechanical and electrical items occurring in finished areas.
 - 12. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
 - 13. Paint interior surfaces of air ducts and convector and baseboard heating cabinets to match face panels.
 - 14. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
 - 15. Repaint existing painted surfaces damaged, abraded, scuffed, or damaged by construction 1 coat.
 - 16. Include painting of mechanical and electrical items in this Section.
- E. Do not paint or finish following.
 - 1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.
 - 2. Items indicated to receive other finish.
 - 3. Items indicated to remain naturally finished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Aluminum components.
 - 6. Polished and brushed stainless steel items.
 - 7. Bronze, terne, and lead items.
 - 8. Metal flashings.
 - 9. Zinc coated guard rails.
 - 10. Interior surfaces of metal siding.
 - 11. Brick.
 - 12. Exterior (weather side) surfaces of concrete.
 - 13. Exterior (weather side) surfaces of precast concrete panels.
 - 14. Exterior (weather side) surfaces of portland cement plaster.
 - 15. Interior surfaces enclosing storage rooms.
 - 16. Interior surfaces enclosing mechanical equipment rooms.
 - 17. Interior surfaces enclosing electrical equipment rooms.

18. Interior surface of concrete roof construction.
 19. Floors.
 20. Surfaces of interior PEMB primary and secondary framing members.
 21. Surfaces concealed by suspended ceilings.
 22. Concealed piping, ductwork, and conduit.
 23. Surfaces within pipe and duct spaces.
 24. Housing and components inside of roof mounted penthouse heating and ventilating units.
 25. Surfaces within elevator shafts.
 26. Surfaces within elevator cars.
 27. Elevator hoistway doors.
 28. Acoustical materials.
 29. Mesh partitions.
 30. Wood paneling.
- F. Painting – Mechanical and Fire Protection Work.
1. Paint exposed interior (in finished areas) and exterior pipe, fittings, ductwork, registers, and equipment in connection with mechanical and fire protection systems, except factory enameled and finish painted components.
 2. Include painting of pipe hangers, ductwork, supports, and brackets.
 3. Do not paint sprinkler heads and polished fire protection components.
 4. Do not paint insulated pipe or equipment before insulation is applied.
 5. Before painting, clean piping, ductwork, and equipment of scale, dirt, and similar foreign matter.
 6. In general, use same paint system and color as adjacent ceilings or walls, however in specific instances use Owner's prescribed color code
 7. Remove unfinished louvers, grilles, covers, and access panels and paint separately.
 8. Paint interior surfaces of ducts, convector cabinets, and dampers visible through grilles and louvers with 1 coat of flat black paint.
 9. Stencil an inscription on each item of equipment designating its number, its function and area served.
 10. Exclude pipe markers from this Section.

3.02 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by 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; report incompatible primer conditions and submit recommended changes for Architect's approval.
- D. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below following maximums.
 1. Plaster and Gypsum Board: 12 percent.
 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
 5. Concrete Floors: 8 percent.
- E. Measure pH factor of concrete, masonry, and mortar before starting any finishing process, using method specified in MPI Architectural Painting Manual.
- F. Report results in writing to Architect before starting work.
- G. If results of test indicates need for remedial action, provide written description of remedial action. If different primer or paint systems is required, state total cost of change. Do not proceed with remedial action or change without receiving written authorization from Architect.

3.03 PREPARATION

- A. Prepare surfaces as specified in MPI Architectural Painting Specification Manual and as follows for applicable surface and coating; if multiple preparation treatments are specified, use as many as necessary for best results; where Manual references external standards for preparation (such as SSPC standards), prepare as specified in those standards; comply with coating manufacturer's specific preparation methods or treatments, if any.
- B. Coordinate painting work with cleaning and preparation work so that dust and other contaminants do not fall on newly painted, wet surfaces.
- C. Surface Appurtenances: Prior to preparing surfaces or finishing, remove electrical plates, hardware, light fixtures, light fixture trim, escutcheons, machined surfaces, fittings, and similar items already installed that are not to be painted.
- D. After completing painting in each space or area, reinstall items removed using workers skilled in trades involved.
- E. Surfaces: Correct defects and clean surfaces which affect work of this Section.
- F. Marks: Seal with shellac those which may bleed through surface finishes.
- G. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- H. Concrete, Cement Plaster 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 solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
 - 1. Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - 2. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - 3. Determine alkalinity and moisture content of surfaces by performing appropriate tests as specified in MPI Manual. If surfaces are sufficiently alkaline to cause finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture is present
 - 4. Etch concrete as specified in MPI Manual.
- I. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
- J. 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.
 - 1. Test coat anodized treatments with primer as recommended by anodized treatment manufacturer; if manufacturer cannot be reasonably found, test in accordance with industry standards.
- K. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
 - 1. Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical or chemical methods as recommended as best practice by primer manufacturer.
- L. 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 wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

1. Use solvent or mechanical cleaning methods that comply with Steel Structures Painting Council's (SSPC) recommendations. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as shop coat.
- M. 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.
- N. Interior Wood Items to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- O. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.04 APPLICATION

- A. Apply products in accordance with manufacturer's instructions and as specified or recommended by MPI Manual, using the preparation, products, sheens, textures, and colors as indicated.
- B. Provide completed work matching approved samples for color, texture, and coverage.
- C. Remove, refinish, or repaint work not complying with requirements.
- D. Do not apply finishes over dirt, rust, scale, grease, moisture, scuffed surfaces, or other conditions detrimental to formation of durable coating film; do not apply finishes to surfaces that are not dry.
- E. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.
 1. Brush Application: Use brushes best suited for type of material applied; use brush of appropriate size for surface or item being painted; produce results free of visible brush marks.
 2. Roller Application: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 3. Spray Application: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
 4. Where application method is listed in the MPI Manual for paint system that application method is required; otherwise any application method recommended by manufacturer for material used and objects to be painted is acceptable.
- F. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.
 1. Number of coats and film thickness required are same regardless of application method.
- G. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
- H. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
- I. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.
- J. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- K. Terminate paint with neat line.
- L. Before applying finish coats, apply prime coat of material recommended by manufacturer, unless surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.
- M. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.

- N. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
- O. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.
- P. If manufacturer's instructions recommend sanding to produce smooth, even surface, sand between coats.
- Q. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- R. Pigmented (Opaque) Finishes: Provide smooth, opaque surface of uniform finish, color, appearance, and coverage.
- S. Stippled Finish: Roll and redistribute paint to even, fine texture; leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections; back roll final coat to achieve uniform surface.
- T. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- U. Dry Erase Paint refer to manufacturers installation instructions prior to application of primer, flat latex and clear dry erase product for all areas that are applicable per drawings.

3.05 FIELD QUALITY CONTROL

- A. Refer to Section 01 4000, for general requirements for field inspection.
- B. Inspect and test questionable coated areas in accordance with Master Painters Institute Architectural Painting Specification Manual.

3.06 CLEANING

- A. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.
- B. At end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.

3.07 PROTECTION

- A. Protect other work, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in MPI Manual.

END OF SECTION

SECTION 10 1400

SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Regulatory room signs.
- B. Emergency evacuation maps.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; current edition; (ADA Standards for Accessible Design).
- B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.
 - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect-Engineer at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by Owner through Architect-Engineer prior to fabrication.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

- A. Do not install tape adhesive 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. Flat Signs:
 - 1. Best Sign Systems, Inc: www.bestsigns.com.
 - 2. Cosco Industries (ADA signs): www.coscoarchitecturalsigns.com.
 - 3. Cosco Industries (non-ADA signs): www.coscoarchitecturalsigns.com.
 - 4. InPro Corporation; Aspen: www.inprocorp.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: All signs are required to comply with ADA Standards for Accessible Design and ANSI/ICC A 117.1 and applicable building codes, unless otherwise indicated; in the

event of conflicting requirements, comply with the most comprehensive and specific requirements.

- B. Room Signs: Provide a sign for Toilet Rooms, JC, and Equipment Room.
 - 1. Sign Type: Flat signs with engraved panel media.
 - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
 - 3. Character Height: 2 inch.
 - 4. Sign Height: 4 inches, unless otherwise indicated.
 - 5. Service Rooms: Identify with the room names and numbers shown on the drawings.
 - 6. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers shown on the drawings, and braille.
- C. Emergency Evacuation Maps:
 - 1. Allow for three maps.
 - 2. Map content to be provided by Owner.
 - 3. Use clear plastic panel silk-screened on reverse, in brushed aluminum frame, screw-mounted.

2.03 SIGN TYPES

- A. Flat Signs: Signage media without frame.
 - 1. Edges: Square.
 - 2. Corners: Square.
 - 3. Wall Mounting of One-Sided Signs: Tape adhesive.
- B. Color and Font: Unless otherwise indicated:
 - 1. Character Font: Helvetica, Arial, or other sans serif font.
 - 2. Character Case: Upper case only.
 - 3. Background Color: Clear.
 - 4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
 - 1. Total Thickness: 1/16 inch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs where indicated:
 - 1. Room and Signs: Locate on wall at latch side of door with centerline of sign at 60 inches above finished floor.
 - 2. If no location is indicated obtain Owner's instructions.
- D. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION

SECTION 10 2800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Toilet and bath accessories.
 - 2. Under-lavatory guards.
 - 3. Custodial accessories.
- B. Related Sections:
 - 1. Division 08 Section "Mirrors" for frameless mirrors.
 - 2. Division 09 Section "Tiling" for ceramic toilet and bath accessories.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Material and finish descriptions.
 - 4. Features that will be included for Project.
 - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
- C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.
- D. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.4 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.
- C. Refer to toilet accessory schedule in drawings for responsibility of purchase and installation.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.
- B. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- C. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

2.02 TOILET AND BATH ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. American Specialties, Inc.
 - 2. Bobrick.
- B. Grab Bar, GB:
 - 1. Basis-of-Design Product: Bobrick, B-5806.
 - 2. Size: 18", 36", 48"
 - 3. Mounting: Flanges with concealed fasteners.
 - 4. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, No. 4 finish (satin).
 - 5. Outside Diameter: 1-1/2 inches (38 mm).
 - 6. Configuration and Length: As indicated on Drawings.
- C. Robe Hook, RH:
 - 1. Basis-of-Design Product: Bobrick, B-672.
 - 2. Description: Double-prong unit.
 - 3. Material and Finish: Stainless steel, No. 4 finish (satin).
- D. Hook Strip, HS:
 - 1. Basis-of-Design Product: Bobrick, B-232x24.
 - 2. Hooks: 3 hooks, 24" length, 1" W, 6'1/2" H; project 2-1/4" from wall.
 - 3. Material and Finish: Stainless steel, No. 4 finish (satin).
- E. Metal Framed Mirrors, M:
 - 1. Basis-of-Design Product: Bobrick, B-293 1630.
 - 2. Description: Tilt ADA Metal frame mirror, 16" W, 30" H
 - 3. Material and Finish: Stainless steel, No. 4 finish (satin).
- F. Coat Rod (CR): see accessories schedule in drawings.
 - 1. Size, finish and location: refer to drawings.

2.03 UNDERLAVATORY GUARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Plumberex Specialty Products, Inc.
 - 2. Truebro by IPS Corporation.
- B. Underlavatory Guard, ULG:
 - 1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
 - 2. Material and Finish: Antimicrobial, molded plastic, white.

2.04 CUSTODIAL ACCESSORIES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. American Specialties, Inc.
- B. Mop and Broom Holder, MR:
 - 1. Basis-of-Design Product: Bobrick, B-224x36.
 - 2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
 - 3. Length: 36 inches (914 mm).
 - 4. Hooks: Three.
 - 5. Mop/Broom Holders: Four spring-loaded, rubber hat, cam type.
 - 6. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel. b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.05 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least **250 lb (1112 N)**, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 09 9000 - Painting and Coating: Field paint finish.

1.03 REFERENCE STANDARDS

- A. NFPA 10 - Standard for Portable Fire Extinguishers ; 2010.
- B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc. ; current edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, and wall bracket mounted measurements.
- C. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. 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 Extinguishers:
 - 1. Ansul, Inc : www.ansul.com.
 - 2. Pyro-Chem : www.pyrochem.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL for the purpose specified and indicated.
- B. Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
 - 1. Class: A:B:C.
 - 2. Size: 10 pound.
 - 3. Finish: Baked polyester powder coat, color as selected.

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. Secure rigidly in place.

END OF SECTION

SECTION 10 5100

LOCKERS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood blocking and nailers.

1.02 REFERENCE STANDARDS

- A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2007.
- B. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines; 2004.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. Product Data: Provide data on locker types, sizes and accessories.
- C. For Review.
 - 1. Shop Drawings: Indicate locker plan layout, numbering plan.
 - 2. Samples: Submit two samples 3 x 6 inches in size, of each color scheduled; applied to specified base metal.
 - 3. Samples for selection.
 - a. Factory-applied painted finishes.
- D. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain lockers through one source from single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal lockers and are based on specific system indicated. See Section 01 6000 - Product Requirements.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect locker finish and adjacent surfaces from damage.

1.06 WARRANTY

- A. See Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Lockers.
 - 1. "Invincible I" by Penco Products, Inc: www.pencoproducts.com, 800-562-1000.
 - 2. Heavy-Duty Ventilated Lockers by Republic Storage Systems Co.: www.republicstorage.com, 800-477-1255.
 - 3. Tufftec 2.0 by Scranton, www.scrantonproducts.com, 800-445-5148.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Sheet Steel: ASTM A 653/A 653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; to following minimum thicknesses.
 - 1. Sides, Bottoms, Tops and Shelf: 16 gage.
 - 2. Backs: Solid 18 gage.
 - 3. Door Outer Face: 14 gage.
 - 4. Door Inner Face: 20 gage, 0.036 inch.
 - 5. Door Frame: 16 gage, 0.060 inch.
 - 6. Hinges: 14 gage, 0.075 inch.
 - 7. Base: 20 gage, 0.036 inch.
 - 8. Trim: 20 gage, 0.036 inch.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
 - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
 - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.03 LOCKER UNITS

- A. Metal Lockers.
 - 1. Width: 12 inches.
 - 2. Depth: 18 inches.
 - 3. Height: 72 inches.
 - 4. Configuration: double tier.
 - 5. Mounting: Surface mounted.
 - 6. Base: Metal base.
 - a. Base Height: 4 inch.
 - 7. Top: Continuous sloping with closures.
 - 8. Locking: Equipped for padlock hasps.
 - 9. Ventilation Method: 3/4 inch wide by 1-1/2 inch high diamond-shaped perforations.
 - 10. Class: Conventional.
 - 11. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.
 - a. Sheet steel, mild, annealed, cold rolled, free from surface imperfections.
 - b. Bottom, back, sides, flat top, and divider panel of locker: 16 gauge steel, flanged for reinforcement, without sharp edges.
 - c. End panels: Flush, 16 gauge steel, reinforced to prevent oil-canning.
 - d. Bolts: Cadmium plated or similar rustproofing process.
 - 12. Frames: Formed channel shape, not less than 16 gauge steel, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
 - a. Type: Simplex.
 - 13. Doors: Hollow double pan, sandwich construction with acoustic insulation fill, 1-3/16 inch thick; welded construction of not less than 16 gauge steel, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.
 - 14. Hinges: Four 2 inch high five-knuckle hinges for doors under 72 inches high, weld securely to locker body and door.
 - a. Full-looped, nonremovable pins.
 - 15. Locking device supplied by Owner.
 - 16. Finish edges smooth without burrs.
 - 17. Fabricate sloped metal tops, ends and closure pieces.
 - 18. Provide end panels and filler strips.

2.04 LOCKER ACCESSORIES

- A. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; finished to match other locker hardware. Attach hooks with at least two fasteners.
 - 1. Provide one double-prong ceiling hook and three single-prong wall hooks for each compartment.

2.05 FINISHING

- A. Paint metal locker bodies and doors in contrasting colors.
- B. Paint metal locker units 2 colors, as scheduled from manufacturer's full range.
- C. Colors as selected by Interior Designer or Architect from manufacturer's standard palette.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Field Measurements: Verify concealed framing, blocking, and reinforcements that support wood lockers by field measurements before being enclosed and before wood locker fabrication, and indicate measurements on shop drawings.
- B. Examine walls, floors, and wood bases for suitable conditions where lockers will be installed.
- C. Verify that prepared bases are in correct position and configuration.
- D. Verify bases and embedded anchors are properly sized.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install lockers plumb and square.
- C. Place and secure on prepared base.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb.
- E. Metal Lockers.
 - 1. Anchor legs to floor with expansion or epoxy anchors.
 - a. At lockers against walls, anchor front legs.
 - 2. Install closure panels between legs on front and exposed ends.
 - 3. Anchor lockers to Z-base using concealed fasteners.
 - 4. At walls at top, anchor lockers with clip angles expansion-bolted to wall and bolted to top of lockers.
 - 5. Over flat tops of lockers, install sloping tops extending continuously over each row of lockers and over fillers and closures.
 - 6. Install vertical closures at ends of sloping tops.
 - 7. Bolt sloping tops to units and firmly secure to walls.
 - 8. Rivet and bolt heads shall not be visible on outside surface.
 - 9. Bolt adjoining locker units together to provide rigid installation.
- F. Install Accessories.
 - 1. Hat shelf: Bolt to sides of lockers.
 - 2. Number Plates: Install plates after lockers are in place.
 - a. Attach number plate on each locker door, near top, centered, with at least two screws with finish matching number plate.
- G. Replace components that do not operate smoothly.

3.03 REPAIR

- A. Touch up marred finishes, or replace lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

3.04 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

3.05 CLEANING

- A. Clean locker interiors and exterior surfaces.

3.06 PROTECTION

- A. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit locker use during construction.

END OF SECTION

SECTION 11 1313
LOADING DOCK BUMPERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dock bumpers of reinforced rubber with attachment frame.

1.02 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate unit dimensions, method of anchorage, and details of construction.
- C. Manufacturer's Installation Instructions: Indicate special installation requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Dock Bumpers:
 - 1. Blue Giant Equipment Corporation: www.bluegiant.com.
 - 2. Durable Corp: www.durablecorp.com.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS

- A. Bumpers: Fabric reinforced rubber pads, ozone resistant, laminated and compressed in position with two galvanized steel rods with threaded ends, washers and nuts; between 3 x 2-1/2 x 1/4 inch galvanized steel angle end plates:
 - 1. Projection From Wall: 4-1/2 inches.
 - 2. Vertical Height: 10 inches.
 - 3. Length: 15 inches.
- B. Attachment Hardware: 3/4 inch diameter galvanized bolts and "L" shaped anchor rods for casting into concrete.
- C. Touch-up Primer: Zinc rich type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that anchor placement is acceptable.

3.02 INSTALLATION

- A. Install dock bumpers in accordance with manufacturer's instructions.
- B. Set plumb and level.
- C. Secure angle end frames to concrete.

END OF SECTION

SECTION 12 2113
HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop drawings.
 - a. Layouts or schedules.
 - 2. Samples for selection.
 - a. Color fan deck.

1.02 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

1.03 WARRANTY

- A. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bali, division of Springs Window Fashions, Fort Mill, South Carolina 29716: www.swfcontract.com.
- B. Hunter Douglas Perimeters, Los Angeles, California 90015: www.hunterdouglas.com as specified.
- C. Levolor Contract, High Point, North Carolina 27265: www.levolor.com.
- D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURED UNITS

- A. Include head channels, valances, tilters, cord locks, drum and cradles, tilt rods, tilt wands, end braces, installation brackets, intermediate brackets, braided ladders, slats, bottom rails and lift cords, and operators and controls.
- B. Horizontal Louver Blinds.
 - 1. Basis of design: Hunter Douglas Décor Aluminum
 - 2. Mounting: To the head of the window opening.
 - 3. Height: extend full height of window.
 - 4. Width: extend full width of window unit. At storefront windows, the blinds width will be the width of each sash, stopping at each vertical mullion.
 - 5. Vane color: Solid bronze finish: #D1-064. Same on both sides.
 - 6. Vane material: Spring Tempered Aluminum, unperforated.
 - 7. Vane size: 1 inch wide.
 - 8. Vane Thickness: .008Inch, minimum.
 - 9. Permanent dust guard feature.
 - 10. Operation: Manual.

2.03 SOURCE QUALITY CONTROL

- A. Blinds shall have color uniformity and be free of sharp edges, burrs, or similar defects which compromise operation or are harmful to persons or materials in contact with blinds.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Take field measurements prior to ordering blinds. Extra compensation will not be made as result of Contractor's failure to observe or become familiar with conditions under which Contractor will work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mount brackets securely to concrete, wood, or hollow construction to support weight of blinds plus forces applied for operation.

3.03 ADJUSTING

- A. Adjust blinds for smooth operation.
- B. Cords and operational components shall operate without application of undue force.

END OF SECTION

SECTION 12 3600
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinetwork.

1.02 RELATED REQUIREMENTS

- A. Section 06 4100 - Architectural Wood Casework.
- B. Section 07 9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2009.
- B. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.
- C. ANSI Z124.3 - American National Standard for Plastic Lavatories; 2005.
- D. ANSI Z124.6 - American National Standard for Plastic Sinks; 2007.
- E. ASTM C568/C568M - Standard Specification for Limestone Dimension Stone; 2010.
- F. ASTM C615/C615M - Standard Specification for Granite Dimension Stone; 2011.
- G. ASTM C1036 - Standard Specification for Flat Glass; 2011.
- H. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2010.
- I. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor; 2007.
- J. ASTM E548 - Standard Guide for General Criteria Used for Evaluating Laboratory Competence; 1994.
- K. ASTM G22 - Standard Practice for Determining Resistance of Plastics to Bacteria; 1976 (Reapproved 1996).
- L. AWI (QCP) - Quality Certification Program, www.awiqcp.org; current edition at www.awiqcp.org.
- M. AWI/AWMAC/MI (AWS) - Architectural Woodwork Standards; 2009.
- N. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. Product Data: Manufacturer's data sheets on each product to be used, including:
 - a. Preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - c. Specimen warranty.
- C. For Review.
 - 1. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
 - a. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and equipment.
 - 2. Samples for verification. Unless otherwise directed, approved sample units in undisturbed condition at time of Substantial Completion may become part of completed work. Notify Architect-Engineer of their exact locations. If not incorporated into work, retain acceptable sample units at project site and remove when directed by Architect-Engineer.
 - a. 6-inch- (150-mm-) square samples for each type of countertop material.
 - b. One of each type of sink specified.

- D. LEED Submittal: Recycled Content of product, indication if product is regionally manufactured and within a 500 miles of the project site.
- E. Installation Instructions: Manufacturer's installation instructions and recommendations.
- F. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.
- B. Perform work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Economic quality, unless other quality is indicated for specific items.
- C. Shop shall be a certified participant in AWI's Quality Certification Program.
- D. Installer Qualifications: Fabricator.
- E. Testing Agency Qualifications: Independent agency qualified for testing indicated, as documented according to ASTM E548.
- F. Source Limitations: Obtain countertops and sinks through one source from single manufacturer.
- G. Coordination drawings shall be prepared indicating plumbing work, electrical work, miscellaneous steel for the general work, and indication of all walls (rated and non-rated), blocking location and recessed wall items.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Do not deliver or install countertops until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during remainder of construction period.
- B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOP ASSEMBLIES

- A. Quality Standard: See Section 06 4100.
- B. Plastic Laminate Countertops: High pressure decorative laminate sheet bonded to substrate.
 - 1. Laminate Sheet: NEMA LD 3 Grade HGP, for post-forming, 0.039 inch nominal thickness.
 - a. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E84.
 - b. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
 - c. Finish: Matte or suede, gloss rating of 5 to 20.
 - d. Surface Color and Pattern: As indicated on drawings.
 - e. Manufacturers:
 - 1) Panolam Industries International, Inc\Pionite Deborah Emory, 770.845.6673, deborah_emory@panolam.com: www.pionitelaminates.com.
 - 2) Wilsonart International, Inc: www.wilsonart.com.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Exposed Edge Treatment: Postformed laminate; front edge substrate built up to minimum 1-1/4 inch thick with raised radiused edge, integral coved backsplash with radiused top edge.

3. Exposed Edge Treatment: Molded PVC edge with T-spline, sized to completely cover edge of panel.
 - a. Color: As scheduled.
 - b. Manufacturers:
 - 1) Charter Industries: www.charterindustries.com, Bob Floyd 1.800.538.9088 ext. 301.
 - 2) Canplast Inc: www.canplast.com, 514.327.9555.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
4. Back and End Splashes: Same material, same construction.
5. Divider Panels: Same material, same construction. Refer to section in contract documents.
6. Fabricate in accordance with AWI/AWMAC Quality Standards Illustrated Standard Grade.

2.02 ACCESSORY MATERIALS

- A. Wood-Based Components:
 1. Wood fabricated from old growth timber is not permitted.
- B. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf (20 kg/cu m) minimum density; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
- C. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
- D. Sand surfaces to which plastic laminate is to be bonded.
- E. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
 1. Color of adhesive to create color-matched seam.
- F. Adhesive for Bonding Plastic Laminate: Resorcinol.
- G. Joint Sealant: Mildew-resistant silicone sealant, white.

2.03 FABRICATION

- A. Countertops, General.
 1. Assemble and finish units at point of manufacture.
 2. Perform assembly on precision jigs to provide units that are square.
 3. Provide units with smooth surfaces in uniform plane free of defects.
 4. Make exposed edges and corners straight and uniformly beveled.
 5. Provide front and end overhang of 1 inch, with continuous drip groove on underside 1/2 inch from edge.
- B. Fabricate tops and splashes in largest sections practicable, with top surface of joints flush.
 1. Join lengths of tops using best method recommended by manufacturer.
 2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
 3. Prepare cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- C. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 2. Height: 4 inches (102 mm), unless otherwise indicated.
- D. Sink/bowl mounting hardware:
 1. Manufacturer's approved bowl clips, brass inserts and fasteners for attachment of undermount sinks/bowls.
- E. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.
 1. Shelf Configuration: Flat, 5/8 inch thick, with beveled edge and corners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas, with installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of countertops.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is the responsibility of another installer, notify Architect-Engineer of unsatisfactory preparation before proceeding.
- D. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under project conditions.

3.03 INSTALLATION

- A. Countertops.
 - 1. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
 - 2. Secure countertops to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
 - 3. Carefully scribe countertops abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
 - 4. Seal backsplashes and to countertops with matching color sealants, as recommended by manufacturer.
 - 5. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.
 - 6. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on shop drawings.
 - 7. Field Jointing: Where possible, make in the same manner as shop jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop.
 - 8. Provide required holes and cutouts for service fittings.
 - 9. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.
 - 10. Provide scribe moldings for closures at junctures of countertop, curb, and splash, with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.
 - 11. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 12. Seal joint between back/end splashes and vertical surfaces.

3.04 REPAIR

- A. Touch-up, repair or replace damaged products before Substantial Completion.

3.05 CLEANING

- A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect-Engineer.

3.06 PROTECTION

- A. Protect installed products until completion of project.

- B. Protect countertop surfaces during construction with 6-mil plastic or other suitable water-resistant covering. Tape to underside of countertop at minimum of 48 inches o.c.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 13 3419
METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufacturer-engineered, shop-fabricated structural steel building frame.
- B. metal wall and roof panels including gutters and downspouts.
- C. Exterior doors, windows, and louvers.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers.
- B. Section 08 1113 - Steel Doors and Frames.
- C. Section 08 3613 - Sectional Doors.
- D. Section 08 7100 - Door Hardware.
- E. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

- A. AISC 326 - Detailing for Steel Construction; 3rd Edition, 2009.
- B. AISC 360 - Specification for Structural Steel Buildings; 2010.
- C. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; 2005.
- D. AISI D100 - Cold-Formed Steel Design Manual; 2008.
- E. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2007 (Ed. 2010).
- F. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 2003 (Reaffirmed 2008).
- G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.
- H. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- I. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2010.
- J. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2013.
- K. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2005 (Reapproved 2009).
- L. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a.
- M. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2012.
- N. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009.
- O. ASTM A1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability; 2012a.
- P. ASTM A1011/A 1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability; 2012b.
- Q. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2011.
- R. ASTM C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.

- S. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2013a.
- T. ASTM E94 - Standard Guide for Radiographic Examination; 2004 (Reapproved 2010).
- U. ASTM E164 - Standard Practice for Ultrasonic Contact Examination of Weldments; 2008.
- V. ASTM E165/E165M - Standard Practice for Liquid Penetrant Examination; 2012.
- W. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- X. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).
- Y. ASTM E709 - Standard Guide for Magnetic Particle Examination; 2008.
- Z. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2005 (Reapproved 2012).
- AA. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995 (Reapproved 2011).
- AB. ASTM E1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems; 2011.
- AC. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.
- AD. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55 and 105 ksi Yield Strength; 2007a e1.
- AE. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.
- AF. DHI (INST) - Installation Guide for Doors and Hardware; 1994.
- AG. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.
- AH. ICC (IBC) - International Building Code; 2009.
- AI. MBMA Recommended Design Practices Manual.
- AJ. MBMA (LR) - Low Rise Building Systems Manual; 2006.
- AK. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.
- AL. SPRI ES-1 - Wind Design Standards for Roof Edge Systems Used with Low Slope Roofing Systems; 2003 (ANSI/SPRI ES-1).
- AM. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel Type I and Type II; 1997 (Ed. 2004).
- AN. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).
- AO. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).

1.04 DESIGN REQUIREMENTS

- A. Design Criteria.
 - 1. In compliance with Metal Building Manufacturers Association and International Building Code.
 - a. When these conflict with other codes and standards, more restrictive requirements shall apply.
 - 2. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.
 - 3. Permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.
 - 4. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.
 - 5. Refer to Contract Drawings for design loads.

6. Load combinations.
 - a. In accordance with Metal Building Manufacturers Association (MBMA) recommendations.
 - b. In accordance with building code requirements.
7. Design using manufacturers standard practices based on applicable sections of current edition of AISC.
8. Design structural system to support mechanical and electrical equipment indicated.
9. Consider spans center to center of support framing.
10. Framing system.
 - a. Material: Hot rolled and cold rolled steel shapes.
 - b. Finish.
 - 1) Clean components of oil, dirt, loose scale, and foreign matter and paint with 1 coat of primer formulated in accordance with SSPC Paint 25.1.
 - c. Primary framing.
 - 1) Design rigid frames on basis of elastic behavior.
 - 2) Analyze column bases as pinned, no base moments.
 - 3) Design anchor rods for uplift and shear loads.
 - d. Primary endwall framing.
 - 1) Design end walls to be expandable.
 - e. Secondary framing.
 - 1) For bays 30 feet and under: Purlins, Z-shaped members not less than 8 inches deep and not less than 0.056 inch thick, designed as simple or continuous span for specified loads.
 - 2) Roof struts: Roof purlin or equal section as required by design.
 - 3) Design eave struts as simple span for specified loads.
 - 4) Design secondary framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.
 - f. Canopy framing and overhangs.
 - 1) Design to withstand required loads.
11. Wall.
 - a. Deflection of assembled metal siding: Not more than 1/180 of span when subjected to specified wind load.
 - b. Provide metal panel assemblies capable of withstanding effects of loads and stresses indicated, based on testing in accordance with ASTM E1592.
 - c. Provide metal panel assemblies tested for thermal performance in accordance with ASTM C1363.
 - d. Air leakage through wall panel assembly of not more than 0.06 cubic feet per minute/square foot of wall area when tested according to ASTM E283 at static-air-pressure difference of 6.24 pounds per square foot.
 - e. No water penetration through wall panel assembly when tested according to ASTM E331 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 pounds per square foot and not more than 12 pounds per square foot.
 - f. Siding System 1 (PEB-S1).
 - 1) Material: Aluminum/zinc coated sheet steel.
 - 2) Thickness: Not less than 0.0179 inch (26 gauge).
 - 3) Type: Panel Rib Wall Panel (Varco Pruden Basis of Design)
 - 4) Fastener system: Exposed.
 - 5) Finish exterior.
 - (a) Material: Fluoropolymer coating as specified in this Section.
 - 6) Finish interior.
 - (a) Material: Epoxy primer and siliconized polyester topcoat.
 - 7) Insulation: Batt, 6 inches thick, white faced.

12. Roof.
 - a. Design roof system for structural performance subject to positive, uniform, concentrated, and negative loads and uplift wind.
 - b. Windstorm rating Factory Mutual 1-90.
 - c. Provide metal panel assemblies capable of withstanding effects of loads and stresses indicated, based on testing in accordance with ASTM E1592.
 - d. Provide metal panel assemblies tested for thermal performance in accordance with ASTM C1363.
 - e. Roof panel deflection downward: Not exceed 1/240 of span when load is placed at mid-point.
 - f. Air leakage through roof panel assembly of not more than 0.06 cubic feet per minute/square foot of roof area when tested according to ASTM E1680 at negative test-pressure difference of 1.57 pounds per square foot.
 - g. No water penetration through roof panel assembly when tested according to ASTM E1646 at test-pressure difference of 2.86 pounds per square foot.
 - h. Roof System 1 (PEB-R1).
 - 1) Material: Aluminum/zinc coated sheet steel.
 - 2) Thickness: Not less than 0.0227 inch (24 gauge).
 - 3) Type: SSR-Standing Seam Roof (Varco Pruden Basis of Design)
 - 4) Finish exterior: Fluoropolymer coating as specified in this Section.
 - 5) Finish interior: Aluminum/zinc coating as specified in this Section.
 - 6) Insulation: Batt, 2 layers: 4 inches unfaced over 6 inches thick, white faced with 1 inch thermal blocks at purlins.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. For Information.
 1. Product Data: Provide data on profiles, component dimensions, fasteners.
 2. Design Data.
 - a. Calculations for building framing systems and components, signed and sealed by Design Professional.
 3. Manufacturer's Instructions: Indicate preparation requirements, anchor bolt placement.
- C. For Review.
 1. Certification of design criteria included in design of metal building systems, signed and sealed by Design Professional licensed in the State of Alabama.
 2. Metal building systems plans, elevations, cross sections, and anchor bolt setting plan, signed and sealed by Design Professional licensed in the State of Alabama.
 3. Certification roof edge design is in compliance with ANSI/SPRI ES-1 as required by International Building Code.
 4. Samples: Submit two samples of precoated metal panels for each color selected, 12 x 12 (305 x 305 mm) inches in size illustrating color and texture of finish.
- D. For Closeout.
 1. Project Record Documents: Record actual locations of concealed components and utilities.

1.07 QUALITY ASSURANCE

- A. Design structural components, develop shop drawings, and perform shop and site work under direct supervision of Design Professional (Specialty Structural Engineer) experienced in design of this Work.
 1. Design Professional Qualifications: Legally qualified (licensed) in Alabama to practice structural engineering.
 2. Experienced in providing design services of kind indicated.

3. Accepts responsibility for design of Metal Building Systems in accordance with Contract Documents.
4. Cooperate with regulatory agency or authority and provide data as requested.
- B. Perform work in accordance with AISC 360 - Specification for Structural Steel Buildings.
- C. Perform welding in accordance with AWS D1.1.
 1. Employ welders who have successfully passed examination for class of work upon which they are employed for structural strength welds.
 2. Welder shall have passed examination within past 6 months or been steadily employed in this type of welding after passing examination within past 2 years as prescribed under qualification procedures of AWS.
 3. Notify Architect-Engineer in sufficient time to visit shop to review and discuss matters pertaining to welding procedures and have resolution of same prior to start of welding or material preparation relating to welding.
 4. Furnish Architect-Engineer with written schedule of proposed shop fabrication in advance of start of fabrication. Keep inspector informed of subsequent schedule changes.
- D. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
 1. Not less than 3 years of documented experience
- E. Erector Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within five year period after Date of Substantial Completion.
- C. Deliver to Owner manufacturer's guarantee covering paint for period of 10 years.
- D. Deliver to Owner manufacturer's guarantee covering color warranty for period of 10 years and weathertightness warranty and guarantee of performance of roof panels for period of 20 years.
- E. Standard manufacturer's roofing guarantees which contain language regarding the governing of the guarantee by any state other than Alabama must be amended to exclude such language; and substituting the requirements that the Laws of the State of Alabama shall govern all such guarantees.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Building Systems:
 1. American Steel Building Company, Inc.: www.americanbuildings.com.
 2. Butler Manufacturing Company: www.buttermfg.com.
 3. Ceco Building Systems: www.cecobuildings.com.
 4. Kirby Building Systems: www.kirbybuildingsystems.com.
 5. MBCI: www.mbc.com.
 6. Nucor Building Systems: www.nucorbuildingsystems.com
 7. Star Building Systems: www.starbuildings.com.
 8. United Structures of America, Inc.: www.usabldg.com.
 9. VP Buildings: www.vp.com. **(BASIS OF DESIGN)**
 10. Oakland Metal Buildings: www.oaklandmetal.com
 11. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS - FRAMING

- A. Structural Steel Members: ASTM A36/A36M.
- B. Plate or Bar Stock: ASTM A529/A529M, Grade 55.

- C. Bolts for primary framing: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A 153/A 153M, Class C.
- D. Nuts for primary framing: ASTM A563.
- E. Washers for primary framing: ASTM F436.
- F. Bolts and nuts for secondary framing: ASTM A307.
- G. Anchor rods: ASTM F1554 (36 ksi yield strength).
- H. Welding Materials: Type required for materials being welded.
- I. Primer: SSPC Paint 25.1.

2.03 MATERIALS - WALLS AND ROOF

- A. Measure thickness in terms of uncoated steel sheet, thickness not less than 0.0227 inch (24 gauge).
 - 1. Zinc-coating: Designation G90.
- B. Insulation: Batt glass fiber type, unfaced, ASTM E84 flame spread index of 25 or less where exposed, friction fit.
- C. Joint Seal Gaskets: Manufacturer's standard type.
- D. Fasteners: Manufacturer's standard type, galvanized to comply with requirements of ASTM A 153/A 153M, finish to match adjacent surfaces when exterior exposed.
- E. Screws: Self-tapping or self-drilling type, zinc plated or stainless steel with color coated heads and neoprene or EDPM washers.
- F. Bituminous Paint: Asphaltic type.
- G. Joint sealants: Polysulfide or polyurethane in accordance with ASTM C920, Type M, Grade NS, Class 25, Use O.
- H. Tape sealants: Preformed butyl rubber base.
- I. Trim, Closure Pieces, Caps, Flashings, Facias: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

2.04 COMPONENTS

- A. Doors and Frames: Specified in Section 08 1113.
- B. Overhead Doors: Specified in Section 08 3613.
- C. Glass and Glazing: Specified in Section 08 8000.

2.05 FABRICATION - GENERAL

- A. Fabricate components square and true.
- B. Fabricate corner covers, closures, and trim to shape and size required.
- C. Fabricate flashings and form to sizes and shapes shown on drawings.
- D. Surfaces free of scratches and blemishes, and with uniform appearance.
- E. Protect components in shipment and storage to prevent damage.
- F. Use protected slings and special rigging to prevent damage to finish during handling and erection.
- G. Painting.
 - 1. Thoroughly clean surface to be shop painted of rust, scale, and dirt in accordance with SSPC-SP3.
 - 2. Coat completed pieces before leaving shop.
 - 3. Surfaces not in contact but inaccessible after assembling in shop or field shall receive 2 coats before assembling.

2.06 FABRICATION - FRAMING

- A. Fabricate members in accordance with AISC Specification for plate, bar, tube, or rolled structural shapes.
- B. Clear span single gable rigid frame with variable depth column and rafter sections of shop welded plates.
- C. Primary framing.
 - 1. Material: Structural plate or bar stock, not less than 50,000 psi yield strength.
 - 2. Fabricate columns and rafters complete with holes in web and flanges for attachment of secondary members.
 - 3. Factory weld baseplates, cap plates, stiffeners and splice plates into place as required complete with holes for connection of other primary and secondary structural members.
 - 4. Join flanges and webs of structural members fabricated of plate, bar stock, or channels using continuous automatic submerged arc welding process.
 - 5. Perform welding using certified welders in accordance with standard practices of AWS.
 - 6. Field bolt primary rigid frame using high-strength bolts in accordance with ASTM A325.
 - a. Bolt finish: Uncoated.
- D. Primary endwall framing.
 - 1. Consists of main load carrying members of building endwalls, including corner columns, endwall columns, and end rafters.
 - 2. Manufacture from cold formed light gauge sections, welded plate sections or structural sections, not less than 50,000 psi yield strength, fabricated for field bolted assembly.
 - 3. Join flanges and webs of structural members fabricated of plate stock using continuous automatic submerged arc welding process.
 - 4. Perform welding using certified welders in accordance with standard practices of AWS.
 - 5. Field bolt primary rigid frame using not less than two 1/2 inch diameter bolts at each connection.
 - 6. South end wall is to be designed to allow building to be expandable.
- E. Secondary framing.
 - 1. Consists of structural members which carry loads to primary framing systems and consists of purlins, bar joists, girts, eave struts, rake angles and other miscellaneous structural members.
 - 2. Manufacture of cold formed light gauge sections or welded plate sections, not less than 50,000 psi yield strength.
 - 3. Eave struts: Unequal flange, C-shaped members, not less than 0.068 inch (16 gauge) thick and not less than 7 inches deep, designed as simple span for specified loads.
 - 4. Girts: Flush-framed of depth required by structural design criteria.
 - 5. Roof Struts: Roof purlin or equal section as required by design.
 - 6. Base angle: Not less than 3 inches by 2 inches, not less than 0.068 inch (16 gauge) thick zinc coated steel.
- F. Canopy framing.
 - 1. Manufacturer's standard structural framing system, fabricated from shop-welded, built-up steel plates or structural steel shapes.
 - 2. Provide frames with attachment plates and splice members, factory drilled for field-bolted assembly.
 - 3. Type: Straight-beam, eave type.
- G. Shop connections.
 - 1. Connections shall be symmetrical.
 - 2. 1-sided connections require acceptance by Architect-Engineer.
 - 3. Accurately space holes for bolts and with diameter 1/16 inch greater than nominal diameter of bolt.
 - 4. Drill holes for material.
 - a. With thickness in excess of bolt diameter plus 1/8 inch.

- b. 7/8 inch thick or greater for 13/16 inch diameter holes and smaller.
 - c. 1-1/8 inches thick or greater for 15/16 inch diameter holes.
- 5. Welding and workmanship shall be governed by AISI Specifications and AWS D1.1.
- 6. Shop weld in accordance with shielded metal arc, gas metal arc with carbon dioxide shielding, submerged arc welding, or flux cored arc welding process.
- 7. For shielded metal arc, gas metal arc, or flux cored arc welding process, use E70 Series, low hydrogen electrodes in full accordance with AWS Specifications.
- 8. Bare electrodes and flux used in combination for submerged arc welding process: F7X Series complying with AWS Specifications.
- 9. Before welding, clean surfaces of loose slag, scale, rust, grease, paint and similar foreign material.
- 10. Use jigs and clamps to prevent distortion during welding.
- 11. Design details so that as much shop work as possible is flat.
- 12. Employ procedures to prevent undercutting, insufficient throat or leg, lack of fusion, or spattering.
- H. Anchor Rods: Formed with bent shank, assembled with template for casting into concrete.
 - 1. Furnish anchor rods complete with standard hexagon nuts and washers, anchor rod setting plan, and forward to field for installation by others in time to prevent delays in work of other contractors.
- I. Leveling Plates.
 - 1. Furnish and install 1/4 inch thick steel plates for use in leveling framing bases.
 - 2. Fabricate and deliver flat.
 - 3. Steel shims are prohibited for use in leveling framing bases.
- J. Supportive Members.
 - 1. Wind bracing.
 - a. System of diagonal rod bracing, portal frames and diaphragm action of roof and wall covering, designed for specified loads.
 - b. Include necessary threaded rods, bracing washers, flat washers, and adjusting nuts at each end.
 - 2. Rigid portal frames for doors, louvers, ducts, and similar components: Fabricate complete with holes in webs, flanges, cap plates, splice plates, and base plates for field bolted assembly.
 - 3. Flange braces: Manufacture from steel angles of gauge and yield of steel designed to specified loads and attach to purlin or girt to stiffen flanges of rigid frames as dictated by design and noted on manufacturer's drawings.
 - 4. Sag angles: Manufacture from not less than 1-5/8 inch by 1-5/8 inch by 0.056 inch angle steel and attach to eave strut and purlins as dictated by design and noted on manufacturer's drawings.

2.07 FABRICATION - WALL AND ROOF PANELS

- A. Siding.
 - 1. Configuration: Metal Building System Manufacturer's standard ribbed panels with semi-concealed fasteners installed from exterior.
 - 2. Net coverage: 36 inches.
 - 3. Side laps: 1 full rib.
 - 4. Length: Eave to sill/base attachment, except where panel length exceeds 40 feet.
 - 5. Material: Sheet steel, not less than 0.0179 inch (26 gauge), 50,000 pounds per square inch yield strength.
 - 6. Ribs: 1-1/4 inch at 12 inches on centers with valley shapes or minor ribs between.
 - 7. Finishes as specified under heading, Design Requirements.
 - 8. Edges sealed with factory applied seals along edge for weathertightness and to prevent dust and air infiltration.
 - 9. Fasten panels to base, eave, and gable at 12 inches on centers.
 - 10. Fasten to girts at 3 feet on centers.

11. Insulation for Walls.
 - a. Insulation.
 - 1) Material: Glass fiber insulation blanket in accordance with ASTM C991, Type II.
 - 2) R-value: 19.
 - 3) Thickness: 6 inches.
 - 4) Density: 0.5 pound per cubic foot.
 - 5) Continuous 3-inch wide edge tabs.
 - b. Facing.
 - 1) Material: White polypropylene/scrim/kraft paper, WMP-30 by Lamtec Corporation.
 - 2) Water vapor transmission rate: Not more than 0.02 perm.
 - 3) Factory laminated to glass fiber.
 - 4) Flame spread index of not more than 25, and smoke developed of not more than 50, when tested in accordance with ASTM E84.
 - c. Acceptable products.
 - 1) Faced Blanket Insulation for Metal Buildings by CGI Silvercote: www.silvercote.com.
 - 2) Faced Metal Building Insulation Blanket by Guardian Fiberglass Inc.: www.guardianfiberglass.com.
 - 3) Microlite "L" by Johns Manville Corp.: www.jm.com.
- B. Roofing.
 1. Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations.
 2. Form roofing material to profile selected by Architect-Engineer from manufacturer's standard offerings.
 3. Standing seam roof system.
 - a. Net coverage: 24 inches.
 - b. Seam rib: Not less than 2 inches high at 24 inches on center with 2 minor ribs between.
 - c. Installed using concealed steel clips, snaplocked at side joints.
 - d. Length: Ridge to eave except where panel length exceeds 40 feet.
 - e. Material: Sheet steel, not less than 0.0239 inch (24 gauge) thick, 50,000 pounds per square inch yield strength.
 - f. Support system shall raise and support panels 3/8 inch above secondary structural framing to accommodate compression of blanket insulation.
 - g. Finishes as specified under heading, Design Requirements.
 - h. Weatherproofed with factory applied sealants along edge seals for weather tightness, to prevent condensation within panel joint, and to comply with guarantee provisions.
 - i. Field seamed with electrically operated seaming machine.
 - j. Endlaps: Not less than 7 inches and occurring over supporting member.
 - k. Clips for attachment to structural members interlock with seamed panel ribs and allow not less than 1 inch panel movement in either direction from center of clip, to compensate for thermal effects.
 - l. Include crickets at curbs and equipment supports, flashings and trim.
 4. Roof Insulation.
 - a. Insulation for Roof System 1 (PEB-R 1).
 - 1) Material: Glass fiber blanket in accordance with ASTM C991, Type II.
 - 2) R-value: Not less than 32
 - 3) Thickness: 2 layers, 4 inches unfaced over 6 inches faced.
 - 4) Density: 0.5 pound per cubic foot.
 - 5) Continuous 3-inch wide edge tabs.
 - b. Facing.
 - 1) Material: White polypropylene/scrim/kraft paper, WMP-30 by Lamtec Corporation.

- 2) Water vapor transmission rate: Not more than 0.02 perm.
- 3) Factory laminated to glass fiber.
- 4) Flame spread index of not more than 25, and smoke developed of not more than 50, when tested in accordance with ASTM E84.
- c. Acceptable products.
 - 1) Faced Blanket Insulation for Metal Buildings by CGI Silvercote: www.silvercote.com.
 - 2) Faced Metal Building Insulation Blanket by Guardian Fiberglass Inc.: www.guardianfiberglass.com.
 - 3) Microlite "L" by Johns Manville Corp.: www.jm.com.
- C. Girts/Purlins: Rolled formed structural shape to receive siding, roofing and liner sheet.
- D. Internal and External Corners: Same material thickness and finish as adjacent material, profile brake formed to required angles. Back brace mitered internal corners with 0.0179 inch thick sheet.
- E. Flashings, Closure Pieces, Fascia: Same material and finish as adjacent material, profile to suit system.
- F. Fasteners: To maintain load requirements and weather tight installation, same finish as cladding, non-corrosive type.

2.08 FABRICATION - GUTTERS AND DOWNSPOUTS

- A. Fabricate of same material and finish as roofing metal.
- B. Size for rainfall intensity determined by storm occurrence of 1 in 5 years in accordance with SMACNA Architectural Sheet Metal Manual.
- C. Form gutters and downspouts of profile selected by Architect and size to collect and remove water. Fabricate with connection pieces.
 1. Gutters.
 - a. Suspended box section of not less than 26 gauge galvanized steel formed to match the configuration of trim with cross section of not less than 36 square inches.
 - b. Attach to roof panel using standard fasteners.
 - c. Taper gutter sections for lap joint.
 - d. Seal splices and end closures with aluminized sealant.
 - e. Fasten with trim fasteners.
 - f. Material and finish to match adjacent siding.
 2. Downspouts.
 - a. Form from not less than 0.0179 inch (26 gauge) thick galvanized steel with cross section of not less than 16 square inches.
 - b. Locate where shown on drawings.
 - c. Attach directly to gutter.
 - d. Attach to wall panel using not less than 0.0179 inch (26 gauge) thick galvanized steel straps on 10 foot centers.
 - e. Material and finish to match adjacent siding.
 3. Accessories: Profiled to suit gutters and downspouts.
 - a. Gutter Supports: Brackets.
 - 1) Install strap hangers at 32 inch intervals.
 - b. Downspout Supports: Brackets.
 - c. Close terminal ends of gutters with end caps fabricated to fit gutter profile.
 - d. Furnish and install stock type wire strainer in gutters at outlets.
 4. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.
- D. Form sections in maximum possible lengths. Hem exposed edges. Allow for expansion at joints.
- E. Fabricate support straps of same material and finish as roofing metal, color as selected.

- F. Miter counters.
- G. Seal metal joints.
- H. Coat surfaces to be joined with gutter sealer in sufficient quantity to ensure a watertight joint.

2.09 FINISHES

- A. Framing Members: Clean, prepare, and shop prime. Do not prime surfaces to be field welded.
- B. Exterior Surfaces of Wall Components and Accessories: Precoated enamel on steel of fluoropolymer coating finish, color as selected from manufacturer's standard range.
 - 1. Fluoropolymer Coating.
 - a. Base material: Aluminum/zinc coated sheet steel.
 - b. Pretreatment and cleaning.
 - c. Prime coat: 0.25 to 0.40 mils, modified polyester primer.
 - d. Top coat: 0.70 to 0.85 mils, 70 percent fluoropolymer resin.
 - e. Total thickness: Not less than 1.00 mils.
 - f. Basis-of-design color: See exterior finish schedule on drawings.
 - g. Acceptable resin products.
 - 1) Arkema Group: Kynar 500: www.arkemagroup.com.
 - 2) Solvay Solexis, Inc.: Hylar 5000: www.solvaysolexis.com.
- C. Interior Surfaces of Wall Components and Accessories: Precoated enamel on steel of modified silicone finish, color as selected from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position.
- B. Examine substrates, areas, and conditions, with Erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- C. Before erection proceeds, survey elevations and locations of concrete, masonry bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with Erector present, for compliance with requirements and metal building system manufacturer's tolerances.
- D. Proceed with erection only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION - GENERAL

- A. Erect in accordance with appropriate erection drawings, erection guides, and documents furnished by building manufacturer.
- B. Comply with appropriate legal and safety requirements.
- C. Include temporary bracing, shoring, blocking, bridging, and securing of components during erection process.
- D. Do not field cut, drill, or alter structural members without written approval from Metal Building System Manufacturer's Design Professional.
- E. Field weld in accordance with manual shielded metal arc process.
- F. Protect concrete slab on ground from damage during erection.
 - 1. Use only vehicles with pneumatic tires.
 - 2. Concentrated load on floor slab: Not more than 5000 pounds during construction.

3.03 ERECTION - FRAMING

- A. Erect framing in accordance with AISC 360 - Specification for Structural Steel Buildings.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.

- C. Base Plates.
 - 1. Clean concrete, masonry bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.
 - 2. Clean bottom surface of plates.
 - 3. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 4. Tighten anchor rods after supported members have been positioned and plumbed.
 - 5. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 6. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
 - 7. Neatly finish exposed surfaces; protect grout and allow to cure.
 - 8. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Set column base plates with non-shrink grout to achieve full plate bearing.
- E. Do not field cut or alter structural members without approval.
- F. Align and adjust structural framing before permanently fastening.
 - 1. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing.
 - 2. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 3. Level and plumb individual members of structure.
 - 4. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
 - 5. Maintain erection tolerances of structural framing within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- G. Primary Framing and End Walls.
 - 1. Erect framing true to line, level, plumb, rigid, and secure.
 - 2. Level baseplates to true even plane with full bearing to supporting structures.
 - 3. Use grout to obtain uniform bearing and to maintain level base-line elevation. Moist cure grout for not less than seven days after placement.
 - 4. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.
 - 5. Joint Type: Snug tightened or pretensioned.
- H. Secondary Framing.
 - 1. Erect framing true to line, level, plumb, rigid, and secure.
 - 2. Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts.
 - 3. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 - 4. Locate and space wall girts to suit openings such as doors and windows.
 - 5. Locate canopy framing as indicated.
 - 6. Provide supplemental framing at entire perimeter of openings, including doors, windows and other penetrations of roof and walls.
 - 7. Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- I. After erection, prime welds, abrasions, and surfaces not shop primed.

3.04 ERECTION - WALL AND ROOF PANELS

- A. Examine primary and secondary framing to verify that structural panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 - 1. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before metal panel installation.
- B. Install in accordance with manufacturer's instructions.

- C. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
- D. Fasten cladding system to structural supports, aligned level and plumb.
- E. Anchor metal panels and other components of work securely in place, with provisions for thermal and structural movement.
 - 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 - 2. Install metal panels perpendicular to structural supports, unless otherwise indicated.
 - 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment. Stagger panel splices and end laps to avoid four-panel lap splice condition.
 - 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- F. Locate end laps over supports. End laps minimum 2 inches. Place side laps over bearing.
- G. Lap-Seam Metal Panels.
 - 1. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or metal panels.
 - 2. Install screws in predrilled holes.
 - 3. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints.
 - 4. Lap ribbed or fluted sheets one full rib corrugation.
 - 5. Apply metal panels and associated items for neat and weathertight enclosure.
 - 6. Avoid "panel creep" and application not true to line.
- H. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- I. Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal panel manufacturer.
 - 1. Seal metal panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal panel manufacturer.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 07 9005 - Joint Sealers.

3.05 METAL ROOF PANEL INSTALLATION

- A. Install ridge caps as metal roof panel work proceeds.
- B. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- C. Field-Assembled, Standing-Seam Metal Roof Panels.
 - 1. Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
 - 2. Install clips to supports with self-tapping fasteners.
 - 3. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
 - 5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.

- 6. Provide metal closures at peaks each side of ridge caps.
- D. Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.06 METAL WALL PANEL INSTALLATION

- A. Install metal wall panels in orientation, sizes, and locations indicated on drawings.
- B. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated.
- C. Anchor metal wall panels and other components of work securely in place, with provisions for thermal and structural movement.
- D. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
- E. Shim or otherwise plumb substrates receiving metal wall panels.
- F. When two rows of metal panels are required, lap panels not less than 4 inches.
- G. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
- H. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
- I. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
- J. Install screw fasteners in predrilled holes. Avoid piercing metal flashing with siding fasteners.
- K. Install flashing and trim as metal wall panel work proceeds.
- L. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated, or if not indicated, as necessary for waterproofing.
- M. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws.
- N. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- O. Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.07 THERMAL INSULATION INSTALLATION FOR FIELD-ASSEMBLED METAL PANELS

- A. Install insulation concurrently with metal wall panel installation, in thickness indicated to cover entire wall, according to manufacturer's written instructions.
- B. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
- C. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Install roof opening framing and electrical lighting support clips before installation of roof insulation.
- E. Blanket Roof Insulation.
 - 1. Over framing installation.
 - a. Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members.
 - b. Hold in place by metal roof panel fastened to secondary framing.
- F. Blanket Wall Insulation.
 - 1. Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members.
 - 2. Hold in place by metal wall panels fastened to secondary framing.

3. Retainer strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.08 ERECTION - GUTTERS AND DOWNSPOUTS

- A. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.
- B. Apply bituminous paint on surfaces in contact with cementitious materials.
- C. Slope gutters minimum 1/8 inch/ft.
- D. Install splash pads under each downspout.

3.09 INSTALLATION - ACCESSORIES

- A. Install door frames, doors, overhead doors, and windows and glass in accordance with manufacturer's instructions.
- B. Seal wall and roof accessories watertight and weather tight with sealant in accordance with Section 07 9005.
- C. Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion.
- D. Coordinate installation with flashings and other components.
- E. Install components required for complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- F. Install components for complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- G. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- H. Flashing and Trim.
 1. Comply with performance requirements, manufacturer's written installation instructions.
 2. Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 3. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.
 4. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 5. Cut and fit closures to profile of adjoining material.
 6. Expansion provisions.
 - a. Provide for thermal expansion of exposed flashing and trim.
 - b. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection.
 - c. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- I. Gutters.
 1. Join sections with lapped and riveted sealed joints.
 2. Attach gutters to eave with gutter hangers spaced not more than 4 feet on center using manufacturer's standard fasteners.
 3. Provide end closures and seal watertight with sealant.
 4. Provide for thermal expansion.

- J. Downspouts.
 - 1. Join sections with 1-1/2-inch telescoping joints.
 - 2. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches on center in between.
 - 3. Provide elbows at base of downspouts to direct water away from building.
- K. Louvers.
 - 1. Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
 - 2. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
 - 3. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
 - 4. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
 - 5. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 9005 - Joint Sealers, for sealants applied during louver installation.
- L. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.
- M. After erection, clean soiled components, remove or paint erection marks, and touch-up damaged finish.

3.10 DOOR AND FRAME INSTALLATION

- A. Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturer's written instructions.
- B. Coordinate installation with wall flashings and other components.
- C. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
- D. Install pedestrian doors and frames according to ANSI A250.8. Shim as necessary to comply with DHI A115.1G.
- E. Fit nonfire-rated doors accurately in their respective frames, with following clearances.
 - 1. Between doors and frames at jambs and head: 1/8 inch.
 - 2. Between edges of pairs of doors: 1/8 inch.
 - 3. At door sills with threshold: 3/8 inch.
 - 4. At door sills without threshold: 3/4 inch.
- F. Field Glazing: Comply with installation requirements in Section 08 8000 - Glazing.
- G. Door Hardware.
 - 1. Mount units at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Install surface-mounted items after finishes have been completed on substrates involved.
 - 3. Set units level, plumb, and true to line and location.
 - 4. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 5. Drill and countersink units that are not factory prepared for anchorage fasteners.
 - 6. Space fasteners and anchors according to industry standards.
 - 7. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Section 07 9005 - Joint Sealers.

3.11 WINDOW INSTALLATION

- A. Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fastened in place according to manufacturer's written instructions.
- B. Coordinate installation with wall flashings and other components.
- C. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.

- D. Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.
- E. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
- F. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- G. Mount screens direct to frames with tapped screw clips.
- H. Field Glazing: Comply with installation requirements in Section 08 8000 - Glazing.

3.12 TOLERANCES

- A. Framing Members: 1/4 inch from level; 1/8 inch from plumb.
- B. Siding and Roofing: 1/8 inch from true position.

3.13 FIELD QUALITY CONTROL

- A. Owner will engage qualified testing and inspecting agency to perform following tests and inspections and to submit reports.
- B. Tests and Inspections.
 - 1. High-strength, field-bolted connections: Inspect and test connections during installation according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 - 2. Welded connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1 and following inspection procedures, at inspector's option.
 - a. Liquid penetrant inspection: ASTM E165.
 - b. Magnetic particle inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic inspection: ASTM E164.
 - d. Radiographic inspection: ASTM E94.
 - 3. Correct deficiencies in work that test reports and inspections indicate does not comply with Contract Documents.

3.14 ADJUSTING

- A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.
- B. Door Hardware.
 - 1. Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit.
 - 2. Replace units that cannot be adjusted to operate as intended.
 - 3. Adjust door closers to compensate for final operation of heating and ventilating equipment. Adjust sweep period so that, from open position of 70 degrees, door will take at least 3 seconds to move to point 3 inches from latch, measured to leading edge of door.
- C. Windows.
 - 1. Adjust operating sashes and ventilators, screens, hardware, and accessories for tight fit at contact points and weather stripping for smooth operation and weathertight closure.
 - 2. Lubricate hardware and moving parts.

3.15 CLEANING

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Touchup Painting.
 - 1. After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing and accessories.

2. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or SSPC-SP 3, "Power Tool Cleaning."
 3. Apply compatible primer of same type as shop primer used on adjacent surfaces.
- D. Immediately after installation of doors and frames, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
1. Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION

SECTION 21 0000
FIRE PROTECTION

PART 1 - GENERAL

PART 2 - PRODUCTS

2.01 FIRE PROTECTION

A. General.

1. The Auburn University A.U. Facilities Building 8 shall be fully sprinkled in all areas, even if not required by code. Automatic Fire Sprinkler Systems and Fire Alarm System shall be per current edition of The International Fire Code, NFPA-13, and all State and Local code requirements. Complete Fire Protection System shall be reviewed and approved by Auburn University Fire Safety Program Manager. A new 6-inch water line will be brought to within 5 feet of building per Civil Engineer Design. An Automatic Fire Riser Assembly equip with a double detector check valve assembly and alarm check valve assembly shall be provided.
2. Office Area is Light Hazard and shall have a wet sprinkler system with a density of.10gpm/sq. ft. for most remote 1500 sq. ft.
3. Warehouse Area is Ordinary Hazard Group 2 and shall have a wet sprinkler system with a density of.20gpm/sq. ft. for most remote 1500 sq. ft.
4. Dock Overhang Area is Ordinary Hazard Group 2 shall have a dry system with a density of.20gpm/sq. ft. over entire area. Add as a part of Alternate 1.
5. Sprinkler system control valves will be equipped with tamper switches and locks and chains, pad locks provided by Auburn University. Aboveground piping 2 inches and smaller shall be Black Steel Schedule 40 with screwed joints. Piping 2.5 inches and larger shall be Black Steel Schedule 10 with grooved mechanical joints.
6. Sprinkler heads in finished areas to be chrome-plated pendant type, unless noted to be flush mounted with cover plate to match finish ceilings.

PART 3 - EXECUTION

END OF SECTION

SECTION 21 0500
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 21 0600 - Basic Fire Suppression Materials and Methods.
- B. Section 21 1008 - Hangers and Supports for Fire Protection.
- C. Division 26 - Electrical.

1.02 REFERENCE STANDARDS

- A. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2013.

1.03 CONTRACTOR COORDINATION REQUIREMENTS

- A. Coordinate installation of fire protection including associated support systems with existing systems and supports and other building trades, equipment, and systems, to avoid interferences between individual trades and between trades and building construction.
- B. Design of mechanical and electrical systems in ceiling space has been coordinated to avoid interferences between major components of each system.
 - 1. Final coordination of components shall be performed by installation contractors.
 - 2. Contract Documents include suggested ceiling space zoning concepts to assist contractors in final coordination.
- C. Prepare fire protection installation drawings for purpose of coordination with other trades. Sheet Metal Contractor shall be responsible for collecting installation documentation from mechanical, electrical, and information technology (IT) trades and create coordination drawings.
- D. Construction Manager shall distribute final coordination drawings to all contractors.
 - 1. Construction Manager shall schedule periodic coordination meetings to resolve interferences.
 - 2. Upon mutual agreement to overall coordination by contractors involved, contractors shall revise their installation drawings to reflect agreed upon location of their respective services.
 - 3. Fire Protection Contractor shall revise coordination drawings after interferences have been resolved.
 - 4. Fabrication and installation of fire protection shall not commence until coordination drawings have been finalized.
- E. Fire protection that is not installed according to final coordination drawings shall be corrected at Contractor's expense.
- F. All required Fire Protection System plans must be reviewed and approved by the Auburn University Fire Safety Program Manager.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- C. For Closeout.
 - 1. Project Record Documents: Record actual locations of components and tag numbering.
 - a. Power and control circuits of assembly, including ladder type elementary schematic diagrams, and interconnection wiring diagrams, having numbered terminal and wire numbers corresponding to designations on terminal strips and control components.
 - 2. Operation and Maintenance Data: Include installation instructions and spare parts lists.

- a. Equipment operation and maintenance instructions, each set separately bound in hard cover, 3-ring binder containing same type paper sheets for items, and consisting of following:
 - 1) Description of system.
 - 2) Installation and operating instructions.
 - 3) Maintenance requirements for equipment.
 - 4) Parts lists.
- b. Obtain information from manufacturers of major equipment and control systems on firms that are factory authorized for maintenance and repair services.
- c. List containing following information:
 - 1) Type of equipment or system.
 - 2) Name, address, and telephone number of authorized service organization, including phone number designated for receiving service calls during nonbusiness hours.
 - 3) Names of personnel responsible for receiving or responding to requests for service calls.

1.05 QUALITY ASSURANCE

- A. Qualifications.
 - 1. Use vendors and equipment manufacturers capable of furnishing local support.
 - 2. Materials and equipment shall be purchased for this project with manufacturer's full warranty, and certified as specified manufacturer's products. Unacceptable are surplus materials from other projects, obsolete or discontinued products, and products rebuilt, remanufactured, or altered in materials, markings, labels, or nameplates.
 - 3. Furnish equipment that is listed and labeled.
 - a. Listed and Labeled as defined in NEC Article 100.
 - b. Listing and Labeling Agency Qualifications, a Nationally Recognized Testing Laboratory (NRTL) as defined in OSHA Regulation 1910.7.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.
- B. Deliver.
 - 1. To site in original unopened containers and pallets bearing manufacturer's name and brand.
 - 2. Affix labels to products, pallets, and containers.
 - 3. Delivered products and containers without complete labels may be rejected.
- C. Store.
 - 1. On level, aboveground platforms.
 - 2. Keep containers dry and free from dust and other airborne contaminants.
 - 3. Protect stored absorptive material from moisture damage.
 - 4. Promptly remove adhesives and adhesive tapes from material and equipment surfaces, where prolonged contact could damage surfaces.
- D. Piping Systems.
 - 1. Cover threaded pipe, fitting, and valve ends with thread protectors.
 - 2. Support stored pipe to prevent permanent deformation from ovalizing, crushing, or sagging.
 - 3. Protect machined surfaces from nicks, dents, scratches, and abrasions, and protect valve yokes, stems, handwheels, operators, and linkage from undue stresses.
 - 4. Protect piping from dust and moisture.
- E. Equipment.
 - 1. Deliver in cartons, crates, or on sleepers.

2. Hoist, transport, rig, and store equipment to prevent damage.
 3. Seal openings to prevent entry of dust, dirt, water, and other contaminants.
 4. Store boxed equipment on shelves.
 5. Crated equipment and equipment mounted on sleepers may be stored on ground, if no part of equipment comes in contact with ground or with water.
- F. Instrumentation.
1. Deliver in original containers and packed to withstand shocks of anticipated handling.
 2. Store instrumentation in dry locations, off floor and protect from dirt, moisture, dust, and other contaminants.

1.07 WARRANTY

- A. See Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 FIRE PROTECTION SYSTEMS

- A. Sprinkler Systems: Conform work to NFPA 13.
- B. Welding Materials and Procedures: Conform to ASME Code.

2.02 MATERIALS

2.03 ELECTRICAL SYSTEM CHARACTERISTICS

- A. Electrical supply.
1. Power: 480 volts, 3 phase, 60 hertz, and 120 volts, single phase, 60 hertz.
 2. Control: 120 volts and lower, single phase, 60 hertz, and 24 volt direct current.
- B. Furnish and install for package, self-contained equipment.
1. Electrical components.
 - a. Factory mounted.
 - b. Factory piped.
 - c. Factory wired.
 - 1) Wiring mounted on external surfaces of equipment factory installed within conduit.
 - d. Totally interconnected.
 2. Load side power connections.
 3. Mechanical and electrical controls.

PART 3 EXECUTION

3.01 PREPARATION

3.02 INSTALLATION

- A. Systems and Equipment.
1. Where Contract requires work to exceed standards required by applicable laws, ordinances, rules, regulations, or other statutory provisions, perform and complete work in accordance with Contract requirements.
 2. Install systems and equipment in accordance with shop drawings reviewed by Architect-Engineer.
 3. Coordinate installation of piping equipment with work of other sections to avoid interferences.
 4. Resolve interferences with other work.
 5. Avoid system intrusion into occupied space, unsightliness, and clutter.
 6. Maintain clearances for installation, operation, expected motion, actuation, servicing, removal, and reinstallation of system components and equipment.
 7. Arrange piping systems for uniform specified pitch, for complete drainability, and for ready ventability.
- B. Access Doors in Walls and Ceilings.

1. Coordinate installation of access doors with other trades where required to maintain serviceability of fire protection system components.
 2. Refer to Section 08 3100, Access Doors and Frames
- C. Painting.
1. Finish painting for work under Division 21 is specified in Section 09 9100 - Painting.
 2. Equipment shall be either factory prime coated or factory finish painted.
 3. Perform touch up where factory prime coat or factory finish have been scratched, abraded, dulled, or otherwise damaged or rendered unsightly.
 4. Touch up shall restore original finish as to color, texture, and gloss, and shall be indistinguishable from original finish.

3.03 FIELD QUALITY CONTROL

- A. Equipment.
1. Furnish manufacturer's factory authorized service for adjustments and start-up, where required for preservation of guarantees.
 2. Do not jog or start equipment until completion of factory authorized service.
 3. Clean and degrease equipment.
 4. Check nameplates for readability.
 - a. Remove paint smears.
 - b. Where nameplates are illegible, arrange for replacement by equipment manufacturer.
 5. Motor driven equipment.
 - a. Start equipment and make sure thermal overload protection will not shut down motor during acceleration period.
 - b. Check motors for direction of rotation.
 - c. Obtain assistance where required to reverse motor direction.
 - d. Check identification, instruction, and warning labels.
 - e. Prepare lubrication schedule and deliver this schedule to Owner.
 - f. Schedule for each piece of equipment to include.
 - 1) Locations for lubricant application.
 - 2) Type of lubricant.
 - 3) Lubricating device.
 - 4) Quantity of lubricant to be dispensed during each application.
 - 5) Frequency of lubrication.
 - g. Check for factory applied lubrication and add lubricant where required.
 - h. In particular, make sure extended lubricating lines are completely filled.
 - i. Check bearing seals.
 - 1) Replace blown seals with seals complying with Contract criteria.
 - 2) Check associated bearings for foreign matter and damage.
 - 3) Flush and relubricate, or furnish and install seals complying with Contract criteria.
 - j. Turn equipment shafts by hand to check for binding or rough bearing action.
 - 1) Investigate causes of binding and rough bearing action.
 - 2) Repair, adjust, or furnish and install components complying with Contract criteria to achieve proper operation.
 - 3) In particular, furnish and install roller and ball bearings complying with Contract criteria if bearing exhibit evidence of race pitting, brinelling, rust, or discoloration.
 - k. Check rotating equipment for smooth operation.
 - l. Rebalance or replace rough running equipment.
 - m. Confirm shaft voltages area 3 volts or less to ground for motors used with variable speed drives.
 6. Flush out corrosion inhibiting compounds, where applied by manufacturer to prevent deterioration in transit and storage.
 7. Witness and certify Acceptance Document for each piece of equipment and each system.

END OF SECTION

SECTION 21 0553

IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tags.
- B. Pipe Markers.

1.02 RELATED REQUIREMENTS

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
 - 2. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
 - 3. Product Data: Provide manufacturers catalog literature for each product required.
 - 4. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- C. For Closeout.
 - 1. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 TAGS

- A. Manufacturers:
 - 1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.
 - 2. Brady Corporation: www.bradycorp.com.
 - 3. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
 - 4. Seton Identification Products: www.seton.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.02 PIPE MARKERS

- A. Furnish and apply custom-made pipe markers to piping defined as follows.
 - 1. Piping exposed to view.
 - a. Piping exposed to view includes piping located in equipment rooms or in spaces that do not conceal piping.
 - 2. Piping located above suspended ceilings.
 - 3. Piping located in accessible shafts.
 - 4. Pipe markers shall identify fluid handled by each system.
 - 5. Markers for insulated pipe and for bare pipe sized 3/4 inch and larger shall indicate direction of fluid flow.
- B. Manufacturers:
 - 1. Brady Corporation: www.bradycorp.com.
 - 2. Craftmark Identification Systems, Specmark.
 - 3. Marking Services, Inc.
 - 4. MIFAB, Inc.: www.mifab.com.
 - 5. Seton Identification Products: www.seton.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- C. Color: Conform to ASME A13.1.

- D. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- E. Color code as follows:
 - 1. Fire Water: Red with white letters.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install plastic pipe markers in accordance with manufacturer's instructions.
- B. Unless otherwise specified, locate pipe markers in accordance with Article 3.1 of ASME A13.1, except with 50 foot maximum intervals.
- C. Install pipe markers as follows.
 - 1. At access panels or doors.
 - 2. Adjacent to valves and branch connections.
 - 3. On both sides of floors, ceilings, and walkways.
 - 4. At major changes in direction.
 - 5. At maximum intervals of 25 feet on straight lengths of pipe.
 - 6. At termination points.
 - 7. At connections to equipment.
- D. Mechanical Equipment.
 - 1. Label in accordance with Owner's requirements.
 - 2. When electric motor location renders nameplate data inaccessible, install duplicate motor nameplate data in easily accessible location on equipment.

3.03 FIELD QUALITY CONTROL

- A. Check factory installed nameplates for readability.
 - 1. Remove paint smears.
 - 2. Where nameplates are illegible, arrange for replacement by equipment manufacturer.
- B. Check directional arrows and apply corrected labels and arrows, where errors are found.

END OF SECTION

SECTION 21 0600

BASIC FIRE SUPPRESSION MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 21 0553 - Identification for Fire Suppression Piping and Equipment
- B. Section 21 1000 - Water-Based Fire-Suppression Systems.
- C. Section 21 1008 - Hangers and Supports for Fire Protection.

1.02 REFERENCE STANDARDS

- A. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2009).
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- C. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2009.
- D. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings for General-Purpose Piping; 2012.
- E. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2011a.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength; 2010.
- G. UL (FPED) - Fire Protection Equipment Directory; current edition.

1.03 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop drawings.
- C. For Closeout.
 - 1. Project Record Documents.
 - a. Piping systems tests.

1.04 QUALITY ASSURANCE

- A. Qualifications.
 - 1. For Pipe Welding: Welding procedures and welder or welding operator performance shall be qualified in accordance with ASME B31.9.
- B. Grooved joint fittings, couplings, valves and specialties shall be of single manufacturer. Grooving tools shall be of same manufacturer as grooved components.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

1.06 WARRANTY

- A. See Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Pressure Gauges.
 - 1. Standard, 6 inch, round gauge with cast aluminum case finished in dull black and fitted with chrome plated ring, or stainless steel case and ring, graduations ranging from zero to twice minimum working pressure on line served, and gauge cock.
 - 2. Include brass or steel siphon on pressure gauges for steam lines.

3. Equip pressure gauges installed on pumped lines with pulsation dampeners.
 4. Acceptable products.
 - a. Ametek, U.S. Gauge Division: No. 5105-S.
 - b. Ashcroft: No. 1010.
 - c. Terice: No. 600.
 - d. Weiss Instruments: NF6S Series.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- B. Floor and Wall Sleeve Materials.
1. Furnish and install sleeves for pipes penetrating building construction.
 2. Furnish and install Schedule 40 black steel sleeves for aboveground interior wall penetrations.
 3. Furnish and install Schedule 40 galvanized steel pipe sleeves for floor penetrations.
 4. Furnish and install steel, nonseepage type sleeves for underground exterior wall and pit penetrations.
 - a. Acceptable manufacturers.
 - 1) Metraflex.
 - 2) Thunderline.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
 5. Size sleeves for pipe lines 4 inches and smaller, not less than 2 pipe sizes larger than pipe passing through.
 6. Size sleeves for pipe lines larger than 4 inches, not less than one pipe size larger than pipe passing through.
 7. Sleeves shall be of sufficient diameter to clear bare or insulated pipe by not less than 1/4 inch all around, and large enough to pass full movement of piping due to expansion or contraction.
 8. Firestopping: Refer to Division 07 for firestopping materials and installation requirements.
 9. Expandable Seals: Mechanically expandable, segmented neoprene inserts.
 - a. Acceptable products.
 - 1) Calpico: Sealing Linx.
 - 2) Flexicraft Industries: Pipe Seal.
 - 3) Metraflex: Metraseal.
 - 4) Thunderline: Link Seal.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
- C. Caulking.
1. Nonhardening, heat resistant compound.
 2. Acceptable products.
 - a. Interchem Presstite: No. 579.64.
 - b. Foster Acoustical Sealer: No. 95-44.
 - c. United States Gypsum: Acoustical Sealant.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- D. Flashing/Counterflashing Materials.
1. Sheet copper, 16 ounces per square foot, in accordance with ASTM B370.
 2. Lead flashing, 4 pound sheet lead in accordance with FS QQ-L-201F(2).
- E. Floor and Ceiling Plates.
1. Pipes sized 2 inches and smaller, chromium plated, cast brass, adjustable plates.
 2. Pipes sized 2-1/2 inches and larger, adjustable cast iron or pressed steel plates.
- F. Flange Gaskets and Bolting.
1. Gasket, Type GASK1: Compressed, nonasbestos, synthetic fiber blend, suitable for service, 1/16 inch thick.
 - a. Acceptable manufacturers.
 - 1) Gasket Resources, Inc.
 - 2) Garlock: Blue-gard.

- 3) Klinger.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- 2. Bolting, Type BOLT1: Machine bolts in accordance with ASTM A307, Grade B and hex nuts in accordance with ASTM A563.
- G. Pipe Thread Compounds.
 - 1. Furnish and install compounds compatible with service, service temperature, and pipe material specified for service.
 - 2. Compounds containing lead are prohibited.

2.02 MATERIALS

- A. Underground Corrosion Protection Materials.
 - 1. Millwrap materials.
 - a. Coal tar pipeline primer.
 - b. Plasticized pipeline enamel.
 - c. Fiberglass wrapper: 0.015 inch thick.
 - d. Perforated organic or fiberglass felt wrapper: 15 pound, coal tar saturated.
 - e. Kraft paper wrapper: 50 to 60 pound.
 - 2. Tape wrap.
 - a. Pressure sensitive, adhesive backed, polyvinyl chloride, or polyethylene tape, 0.020 inch thick.
 - b. Acceptable products.
 - 1) Denso Products: Denso Tape.
 - 2) Minnesota Mining and Manufacturing: Scotchwrap.
 - 3) Polyken Division of the Kendall Co.: Tapewrap.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
 - 3. Hot tape wrap.
 - a. Woven synthetic fabric impregnated with bitumen.
 - b. Acceptable product.
 - 1) Tapecoat Company: Tapecoat.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.
 - 4. Pipe sheath.
 - a. Polyethylene and mastic sheath, in accordance with ASTM D 2103.
 - b. Acceptable products.
 - 1) Energy Coating: X-Tru-Coat.
 - 2) Raychem: Chemelex.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
 - 5. Pipe joint sheath.
 - a. Heat shrunk, 1-piece, thick wall, polyethylene sleeve with inside adhesive coating.
 - b. Acceptable product.
 - 1) Raychem: Thermofit TPS.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.
- B. Type DIWP, Ductile Iron Water Pipe.
 - 1. Pipe.
 - a. Pressure Class 350.
 - b. ANSI/AWWA C151/A21.51, cement lined ductile iron water pipe with ANSI/AWWA /A21.50 rating and ANSI/AWWA C104/A21.4 cement lining.
 - 2. Joints.
 - a. ANSI/AWWA C111/A21.11, mechanical or slip-on joints with rubber gaskets.
 - b. ANSI/AWWA C606, grooved joints; Victaulic Style 31, with FlushSeal gaskets.
 - 3. Fittings.
 - a. 350 psi minimum.
 - b. ANSI/AWWA C110/A21.10, ductile iron or cast iron, cement lined.
 - c. Except for fire protection service, furnish short body type fittings.
 - 4. Flanges.

- a. 125 psi minimum.
 - b. ASTM A126, cast iron.
- C. Type BS-1FP, Black Steel Fire Protection Pipe.
 - 1. Pipe, 16 inches and smaller: Schedule 40, ASTM A53, black steel.
 - 2. Fittings, screwed: 175 pound, ASTM A126, cast iron or ASTM A197, malleable iron.
 - 3. Fittings, flanged: 175 pound, ASTM A126, cast iron.
 - 4. Fittings, butt weld: Standard, ASTM A234, black steel.
 - 5. Unions, screwed: 250 pound, ASTM A197, malleable iron, ground joint.
 - 6. Flanges, welded: 150 pound, ASTM A181, forged steel.
 - 7. Grooved fittings: Standard weight, ASTM A536, galvanized ductile iron.
 - 8. Grooved flanges: 175 pound couplings, ASTM A536, ductile iron. Victaulic Style 741 / 744.
 - 9. Grooved couplings: Two ASTM A 536, ductile iron housings, with slip-on elastomer rubber gasket and ASTM A449 coupling bolts with nuts.
 - a. Lightweight, snap lock, side outlet or plain end type couplings, and mechanical tees are prohibited.
 - b. Couplings that require drilling of holes into pipe are prohibited.
 - 10. Grooved fittings and couplings.
 - a. Acceptable product.
 - 1) Victaulic: Installation-Ready Style 177 and Style 77 (flexible) or Installation-Ready Style 107H and Style 07 ZeroFlex rigid type, with offsetting, angle-pattern bolt pads; and AGS Series W07 and W77 for 14 inches and larger.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.
- D. Type BS-2FP, Black Steel Fire Protection Pipe.
 - 1. Pipe, 2 through 10 inches: Schedule 10, ASTM A135, black steel.
 - 2. Fittings, butt weld: Standard, ASTM A234, black steel.
 - 3. Flanges, welded: 150 pound, ASTM A181, forged steel.
 - 4. Grooved fittings: Standard weight, ASTM A536, galvanized ductile iron.
 - 5. Grooved flanges: 175 pound couplings, ASTM A536, ductile iron. Victaulic Style 741 / 744.
 - 6. Grooved couplings: Two ASTM A536, ductile iron housings, with slip-on elastomer rubber gasket and ASTM A449 coupling bolts with nuts.
 - a. Lightweight, snap lock, side outlet or plain end type couplings, and mechanical tees are prohibited.
 - b. Couplings that require drilling of holes into pipe are prohibited.
 - 7. Grooved fittings and couplings.
 - a. Acceptable product.
 - 1) Victaulic: Installation-Ready Style 177 and Style 77 (flexible) or Installation-Ready Style 107H and Style 07 ZeroFlex rigid type, with offsetting, angle-pattern bolt pads; and AGS Series W07 and W77 for 14 inches and larger.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Earthwork for Underground Systems.
 - 1. Exclude excavation, shoring, and dewatering from this section.
 - 2. Pipe Bedding.
 - a. For granular bedding, Class B.
 - 1) Use material as specified in Section 31 0000.
 - 2) Spread and compact in accordance with Section 31 0000.
 - b. For concrete cradle, Class A.
 - 1) Support lower quarter of pipe exterior on a continuous concrete cradle.
 - 2) Construct of concrete without horizontal construction joints.
 - c. For concrete encasement.
 - 1) Completely encase pipe in concrete without horizontal construction joints.

3. Initial Backfill.
 - a. Do not place around concrete for at least 24 hours after concrete placement.
 - b. Do not disturb or cause damage to fresh concrete.
 - c. Protect pipe and joints from disturbance.
 - d. Place in trenches after pipe is in place and tested.
 - e. Place within 10 feet of end of last pipe section laid.
 - f. Push material from filled end of trench into partially filled section of trench, allowing material to roll down an incline onto covered pipe.
 - g. Do not push material over side of open trench, allowing clear fall onto partially covered pipe.
 - h. Install from pipe bedding to 12 inches above top of highest pipe in trench after compaction.
 - i. Spread and compact in accordance with Section 31 0000.
 4. Exclude backfill from top of initial backfill to grade from this section.
 5. Furnish and install bedding and initial backfill for existing pipe exposed during excavation.
- B. Underground Pipe Corrosion Protection.
1. Mill wrap.
 - a. Pipe 3 inches and smaller, and in lengths greater than 300 linear feet.
 - b. Pipe 4 inches and larger, and in lengths greater than 100 linear feet.
 - c. Factory mill wrap pipe according to following sequence.
 - 1) Thoroughly machine clean pipe.
 - 2) Apply uniform prime coat of coal tar pipeline primer.
 - 3) Apply uniform coat, 3/32 inch thick, of plasticized pipeline enamel.
 - 4) Spiral wrap fiberglass wrapper.
 - 5) Apply uniform coat, 1/32 inch thick, of plasticized pipeline enamel.
 - 6) Spiral wrap perforated pipeline felt wrapper.
 - 7) Spiral wrap kraft paper wrapper.
 - 8) Perform electrical holiday inspection test for flaw detection.
 2. Tape wrap.
 - a. Pipe 3 inches and smaller, and in lengths of 300 linear feet or less.
 - b. Pipe 4 inches and larger, and in lengths of 100 linear feet or less.
 - c. Read manufacturer's instructions before tape is applied.
 - 1) Clean corroded pipe, then prime with primer recommended by tape or sheath manufacturer.
 - 2) Apply tape under warm weather conditions to ensure proper adhesion and in accordance with manufacturer's instructions.
 - 3) Spirally wrap pipe segments, fittings, valves, and connections.
 - 4) Overlap, on successive wrapper passes, minimum of 1/2 width of tape.
 - 5) Cover welded joints with 1 wrap prior to spiral wrapping.
 - 6) Electrical holiday inspection is required for all types.
 3. Hot tape wrap.
 - a. For mill wrapped pipe, apply hot tape wrap to fittings and field joints, compatible with millwrap bitumen, and suitable for specified ambient service conditions.
 - b. May be applied under all weather conditions in accordance with manufacturer's published instructions.
 4. Pipe sheath.
 - a. As option to mill wrapping or tape wrapping, use pipe with factory or field installed sheathing, in conformance with manufacturer's published instructions.
 - b. Apply sheath over pipe material specified for service.
 - c. Bond sheath by adhesives or heat seal.
 - d. Bond pipe end and fittings with thermally fitted heat shrink sleeves.
 - e. Electrical flaw detection testing at factory shall require 10,000 volts to be impressed across sheath.
 - f. Sheath breakdown voltage shall be not less than 13,000 volts.

5. Pipe joint sheath.
 - a. Material compatible with sheath, mill wrap, or tape wrap.
 - b. Field applied using propane torch.
 - c. Suitable for use up through 200 degrees F.
- C. Underground Pipe.
 1. General.
 - a. Check each pipe for cracks and defects before placing into position for laying.
 - b. Clean jointing surfaces of pipe free from material that may have an injurious effect on joint material used.
 - c. Check preplaced joint material for proper position and state required for type of joint specified.
 - d. Lay pipe in selected bedding to required line and grade to have firm, even bearing throughout, with close joints and smooth inverts.
 - e. Make recesses in bedding, shaped to receive pipe joint or fitting.
 - f. Clean foreign matter from interior of each section of pipe before adjoining pipe is laid.
 - g. After each section of pipe is laid and joint has been made, fill space between pipes and trench sides with selected bedding.
 - h. Protect pipe and joints from disturbance.
 - i. Plug open ends of pipe at close of each day's work and when pipes are not being laid.
 - j. Bituminous coat exposed ferrous surfaces, including bolts and clamps, before burying.
 - k. Where underground piping crosses existing sewers, utility pipes, or conduits, take special precautions and protective measures to avoid damage to existing facilities.
 - l. Offset pipes where indicated or where required to avoid interference with other work.
 - m. Make offsets to deeper elevation to avoid pipe freezing.
 2. Where mechanical joints are allowed, joints utilizing retainer gland with setscrews into pipe surface are prohibited.
 3. Where openings are furnished, install piping through prepared foundation wall openings.
 4. Where necessary to install piping below angle of repose of earth support of foundations, encase pipe and backfill with concrete to line of angle of repose.
 5. For pressure pipe, bends, offsets, tees, crosses, and dead ends, including flange and spigot pieces, shall be suitably rodded and clamped or blocked with concrete thrust blocks.
 6. Rods and clamps shall receive one field coat of bituminous coating after installation.
- D. Aboveground Pipe.
 1. Refer to specific piping systems sections for additional requirements.
 2. Install piping in direct, straight, workmanlike manner, concealed where possible, and properly graded.
 3. Particular attention shall be paid to Owner's requirements for clearance.
 4. Piping in finished rooms shall be concealed.
 5. Piping shall not project beyond walls or steel lines, or hang below slabs more than is absolutely necessary.
 6. Fluids shall circulate freely, without noise, and with no evidence of leaks, trapping, or air binding.
 7. After installation, clear each section of pipe of debris and obstructions.
 8. Unless indicated otherwise or to facilitate drainage, take branches from top of mains or at 45 degree angle above horizontal.
 9. Valve branch lines to equipment close to main, unless otherwise shown.
 10. Length of pipe used in offsets between risers and mains shall be sufficient to facilitate expansion and pitched back to main to furnish proper drainage at all times.
 11. Offset piping to avoid interferences, increase headroom, improve appearance of pipe work, and to properly drain piping, in manner acceptable to Architect-Engineer.

12. Openings in pipe shall be kept closed during construction with cast iron or malleable iron caps or plugs.
 13. Make pipe connections to allow flexibility of pipe movement during expansion and contraction.
 14. Install piping so strain and weight will not harm equipment at connections.
 15. Install expansion pipe bends where shown or where necessary to allow for proper pipe expansion.
 - a. Construct bends as shown on drawings.
 - b. Spring bends apart during erection approximately 1/2 of length of expected expansion.
 - c. Construct bends so that original cross sections are round and true, without flat spots or buckles.
 - d. Mitered bends in steel pipe systems will not be accepted.
 16. Branch connections for steel pipe.
 - a. Make branch connections with tees, weldolets, or threadolets, where main exceeds branch by two pipe sizes or more.
 - b. Branch connections shall be made with tees, laterals, or crosses, where main and branch are of equal size, or where main exceeds branch by one pipe size.
 - c. Mitered fittings in steel pipe systems will not be accepted.
 17. Install unions at intervals and locations where they will facilitate disconnection and removal of piping, at screwed valves, at connections to equipment, and elsewhere as shown.
 18. Install flanged joints at valves, equipment, and other final connections 2-1/2 inches in size and larger.
 19. Flanges shall be true faced and placed perpendicular to axis of pipe.
 20. Remove raised face of pipe flanges connecting to flat faced, cast iron, flanged valves.
 21. Paint one side of flange gaskets with graphite and oil before placing into position.
 22. Gaskets shall cover full space inside of flange bolt holes, and no part may extend beyond inside diameter of pipe.
 23. Apply pipe thread compound to male threads only.
 24. Install dielectric fittings where dissimilar metal pipes are joined.
 25. Floor and ceiling plates.
 - a. Install where pipes pass through finished floors, walls, ceilings, and partitions.
 - b. Where insulation is carried through pipe sleeve, completely cover insulation and sleeve.
- E. Ductile Iron Water Pipes
1. Install in accordance with applicable recommendations of DIPRA Handbook of Ductile Iron Pipe and AWWA C600.
- F. Pipe Welding.
1. Perform steel pipe welding in accordance with ASME B31.9 and applicable requirements of authorities having jurisdiction.
 2. For applicable portions of steam and condensate piping (126 psig and over), boiler feedwater piping, and high temperature hot water heating piping, perform pipe welding in accordance with ASME B31.1.
 3. Pipe ends requiring butt welds.
 - a. Ream free of burrs and bevel 37 degrees, plus or minus 2 degrees.
 - b. Center pipe ends and locate 1/8 inch apart, plus or minus 1/32 inch.
 - c. Before applying welding beads, make not less than 4 equally spaced tack welds between pipe end.
 - d. Clean each bead thoroughly before starting following pass.
 4. Remove welds found to be defective.
 - a. Replace defective welds with nondefective welds to ensure compliance with Contract provisions without additional cost to Owner.

- b. Peening of defective welds or applying additional beads to defective welds are not acceptable methods of repair.
- 5. Furnish fire blankets to protect building structure, services, materials, and equipment.
- 6. Furnish and install protective curtains or shields to protect personnel from welder's flash.
- G. Grooved Joints.
 - 1. Install grooved fittings and couplings as recommended by manufacturer.
 - 2. Use only those grooved couplings specified. Substitution of other model, style, size, or rating of couplings or fittings is prohibited.
 - 3. Roll grooving of piping is prohibited for use in galvanized steel pipe systems.
 - 4. Grooved joint coupling manufacturer shall provide on-site training for Contractor's field personnel, and shall periodically visit job site during construction to ensure best practices are being followed.
- H. Air Traps.
 - 1. Install automatic air traps at high points in water systems where air pockets may occur and where shown on drawings.
 - 2. Run drain piping from trap to nearest drain.
- I. Pressure Gauges and Thermometers.
 - 1. Install pressure gauges and thermometer well connections in fittings. Drilling and tapping of pipe wall for connections is prohibited.
 - 2. Locate gauges and thermometers in accordance with manufacturer's instructions and in visible locations for easy reading from normal operating levels.
- J. Sleeves and Seals.
 - 1. Set sleeves in concrete work in position before concrete is poured, and maintain them in position until concrete is set.
 - 2. Holes for sleeves in existing concrete shall be cored.
 - 3. Sleeves through walls shall extend minimum of 1/2 inch beyond wall flange.
 - 4. Install floor sleeves for exposed risers or equipment services flush with ceiling, with planed square ends extending 2 inches above finished floor.
 - 5. Extend floor sleeves for pipe risers in finished areas to extend to uniform height of not more than 2 inches above finished floor.
 - 6. Pipes located within pipe shafts and chases do not require sleeves.
 - 7. Where indicated, seal space between pipe and sleeves in exterior walls, watertight, by packing with oakum and caulking with lead.
 - 8. For underground wall and pit penetrations, and on grade floor penetrations, and where indicated, seal space between pipe sleeves watertight with mechanically expandable, segmented neoprene inserts. Install in accordance with manufacturer's instructions. Bituminous coat all exposed bolt heads.
 - 9. Caulking.
 - a. Caulk pipes passing through interior partitions and walls, airtight around their circumference on both sides of partition.
 - b. Apply caulking between pipe sleeve and exterior surface of pipe or pipe insulation.
 - c. Apply caulking beads in accordance with manufacturer's instructions.
 - d. Unless manufacturer's instructions state otherwise, make sealant beads not thinner than 1/8 inch nor thicker than 3/8 inch.
 - e. Use of general purpose, oil base, caulking compounds, of putties and of plaster will not be accepted for sealing of pipe penetrations.
- K. Flashings/Counterflashings.
 - 1. Size flashing flange minimum of 6 inches larger than outside diameter of pipe, or minimum of 24 inches square, and extend sleeves up around pipes to height of not less than 10 inches above roof line, unless otherwise indicated.
 - 2. Install flashing/counterflashing.
 - 3. For plumbing vent pipe flashing, extend sleeve up inside bottom of either inverted hub connection or reviewed and accepted vent fitting.

4. Where copper flashing is indicated, solder flange and sleeve watertight.
 5. Install copper counterflashing with stainless steel draw bands.
- L. Welding to Building Structure.
1. Welding to building structure is not allowed, unless otherwise specified or specifically accepted by Architect-Engineer.
 2. If so specified or accepted, comply with following requirements.
 - a. Unless otherwise noted, welding and workmanship shall be governed by AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings in conjunction with AWS D1.1.
 - b. Allowable stress in field applied welds using E70 Series and A36 steel.
 - 1) Tension or compression: Same as base metal.
 - 2) Shear: 15,800 pounds per square inch.
 - c. Surfaces to be welded shall be free from loose slag, scale, rust, grease, paint, or other foreign material.
 - d. Before welding, remove paint from painted surfaces to expose clean steel surface.
 - e. Special attention is called to requirement that maximum size of fillet weld that may be assumed in design of connection shall ensure that stresses in adjacent base material do not exceed allowable value for this material.
 - f. No weld transmitting calculated stress shall be less than 3 inches in length, and no intermittent welds shall be less than 2 inches in length.
 - g. No welds shall be applied to flanges of tension members perpendicular to direction of stress.
 - h. Turn side and end fillet welds around corners for a minimum length of twice nominal size of weld.
 - i. To ensure compliance, detail shall be indicated on shop drawings.
 - j. Length of end returns is not be included in calculated weld length.
 - k. No welding or other operation involving use of flame, arcs, or sparking devices will be allowed without written permission of Owner's representative.
 - l. Welds found to be in nonconformance to requirements of AWS D1.1 shall be repaired or replaced according to Workmanship section of AWS D1.1 without cost to Owner.
- M. General Pipe Testing Requirements.
1. Prior to acceptance of work, test completed piping systems, in accordance with applicable governing codes, and in presence of Owner's Field Representative.
 - a. Furnish necessary equipment and materials, and make necessary test connections required to execute tests.
 - b. Make tests before piping surfaces are concealed or insulated.
 - c. Use standard piping plugs, caps, valves, and blind flanges for sealing off piping for testing.
 - d. Removal of system component, including plugs and caps, to ascertain whether or not test media has reached all parts of system if purging or vent valves are not installed during construction, may be required by Owner's Field Representative.
 - e. Remove components from piping systems during testing whenever component may sustain damage due to test pressure or test media.
 - f. After completion of test, reinstall component and reapply test at component pressure rating.
 - g. Check system components and valves for functional operation under system test pressure.
 2. Pressure tests, when specified, shall be carried out in accordance with ASME B31.9.
 3. Pressure test steam and condensate (126 psig and higher), high temperature hot water, and boiler feedwater piping systems in accordance with ASME B31.1.
 4. Take necessary precautions to vent expansive force of compressed air trapped during high pressure hydrostatic testing to preclude injury and damage.
 5. If testing demonstrates leakage.

- a. Determine source(s) of leakage, repair or replace defective materials and workmanship, and retest installation until specified requirements are complied with.
 - b. Replace leaking gasket joints with undamaged gaskets and flange bolting.
 - c. Destroy removed gaskets and bolting.
- 6. For hydrostatic tests: Use only potable water.
- 7. Pneumatic testing.
 - a. Use compressed air, carbon dioxide, or nitrogen, unless otherwise specified or accepted.
 - b. Preliminary testing at 5 psi shall require swabbing joints with soap solution and subsequent observation for bubbles.
- 8. Upon completion of work, but before final acceptance, operate systems for period of two days, for purpose of testing and satisfying requirements, when directed by Architect-Engineer.
- 9. Prepare and maintain test records of piping systems tests.
 - a. List Owner and Contractor personnel present, dates, test gauge identification numbers, ambient temperatures, pressure ranges, rates of pressure drop, and leakage rates.
 - b. Deliver two record copies of acceptance tests to Owner after acceptance.
- 10. Refer to Sections listed under heading, Related Requirements, for requirements specific to individual piping systems.
- N. Flushing and Purging General Requirements.
 - 1. Install temporary and permanent piping, equipment, and materials required for flushing and purging work.
 - 2. Flushing and purging of add-on system into existing system is strictly prohibited.
 - 3. After flushing and purging, valves and strainers shall be removed and cleaned of debris before replacing.
 - 4. Coordinate cleaning of connections to existing systems through Owner Field Representative.
 - 5. Flush and purge systems after successful pressure testing.

3.02 FIELD QUALITY CONTROL

- A. Check that pressure, temperature, and flow measuring devices are placed in correct locations. Make modifications to ensure compliance.
- B. Check scale ranges of individual instruments. Expected normal reading shall be near middle of scale. Replace instruments not conforming to this requirement.
- C. Verify that piping systems have been flushed and filled.
- D. Check valve packings. Adjust or replace leaking valve packings.
- E. Verify piping alignment at flexible connections or expansion joints, in hot and cold condition. Correct misalignment, where joints are found to squirm.

END OF SECTION

SECTION 21 1000
WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 21 0500 - Common Work Results for Fire Suppression.
- B. Section 21 0600 - Basic Fire Suppression Materials and Methods.
- C. Section 21 1008 - Hangers and Supports for Fire Protection.
- D. Division 26 - Electrical.

1.02 REFERENCE STANDARDS

- A. ASME B31.1 - Power Piping; 2012 (ANSI/ASME B31.1).
- B. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2009).
- C. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2009).
- D. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications; 2012.
- E. FM P7825 - Approval Guide; current edition.
- F. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2013.
- G. UL (FPED) - Fire Protection Equipment Directory; current edition.

1.03 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop Drawings.
 - a. Location and elevation of.
 - 1) Water supply piping.
 - 2) Automatic sprinkler riser location.
 - 3) Standpipe.
 - b. Fabrication of overhead system network.
- C. For Information.
 - 1. Product data.
 - a. Alarm check valve.
 - b. Dry pipe valve.
 - c. Deluge valve.
 - d. Alarm and supervisory devices.
 - e. Double detector check valve.
 - f. Fire department connection.
 - g. Wall fire hydrant.
 - h. System identification nameplates.
 - i. Sprinkler heads.
 - j. Pipe hangers and supports.
 - 2. Design data.
 - a. Hydraulic calculations and associated drawings for fire protection system.
 - 3. Test reports.
 - a. Test certificates for hydrostatic testing of system in accordance with NFPA 13.
 - 4. Certificates.
 - a. Test of sprinkler network.
 - b. Underwriters Laboratories listed equipment.
- D. For Closeout.

1. Operation and Maintenance Data.
 - a. Spare parts lists.

1.04 QUALITY ASSURANCE

- A. Hydraulically design systems according to criteria indicated on drawings.
- B. Minimum sprinkler operating pressure: 7 psi.
- C. Maximum water velocity in pipe: 32 feet per second.
- D. Prepare hydraulic calculations on form sheets in accordance with NFPA 13.
- E. Restate and include basic design data and criteria, work sheets, summary sheets, and supply and demand curves.
- F. Clearly indicate hydraulic areas and reference points.
- G. Submit calculations, for each area, to prove design area chosen is most hydraulically remote or most hydraulically demanding area.
- H. Work shown on drawings is schematic or diagrammatic only. Scales and figure dimensions are approximate and are given for estimating purposes.
- I. Drawings indicate general scheme for sprinkler system design. Call exceptions to scheme to Architect-Engineer's attention, before proceeding with work.
- J. Work shall be supervised and performed by personnel regularly engaged in installation of fire protection systems conforming to UL or NFPA Standards. Submit supervisor or installer evidence of qualification, upon request.
- K. Furnish FM approved or UL listed devices and materials where FM approved or UL listed devices and materials are available.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01 6000 - Product Requirements, for transportation, storage, and handling requirements.

1.06 WARRANTY

- A. Refer to Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 SYSTEMS

- A. Automatic Sprinkler System (Wet).
 1. Pipe and fittings.
 - a. Type BS-1FP, black steel fire protection pipe.
 - b. Type BS-2FP, black steel fire protection pipe.
 2. Valves.
 - a. General service fire protection valves.
- B. Automatic Sprinkler System (Dry).
 1. Pipe and fittings.
 - a. Type GS-1 FP, galvanized steel fire protection pipe.
 2. Valves.
 - a. General service fire protection valves.
- C. Pre-action Sprinkler System (Wet).
 1. Pipe and fittings.
 - a. Type GS-1FP, galvanized steel fire protection pipe.
 - b. Galvanized or black steel pipe and fittings in accordance with NFPA 13
 2. Valves.
 - a. General service fire protection valves.

2.02 MANUFACTURED UNITS

- A. General Service Fire Protection Valves.

1. Valves listed are standard Specifications for fire protection service.
2. Where revisions or clarifications are required to establish specific requirements for systems on this project, these are specified under respective service listed.

<u>Type</u>	<u>Rating</u>	<u>Size</u>	<u>Material</u>	<u>Remarks</u>
OS and Y gate valve	175 psi	Through 2 inch	Bronze threaded	Wedge disc Kennedy Fig. 66
OS and Y gate valve	175 psi	2-1/2 through 14 inch	Iron flanged	Double disc Kennedy Fig. 68
NRS gate valve	175 psi	4 through 14 inch	Iron mechanical joint	Double disc Kennedy Fig. 71X
Globe valve	200 pound WOG	Through 2 inch	Bronze threaded	Renewable disc Kennedy Fig. 97-SD
Angle valve	200 pound WOG	Through 2 inch	Bronze threaded	Renewable disc Kennedy Fig. 98-SD
Check valve	200 pound WOG	Through 2 inch	Bronze threaded	Regrindable seat Kennedy Fig. 440-SD
Check valve	175 psi	2-1/2 through 12 inch	Iron body flanged	Bronze disc Kennedy Fig. 126A
Check valve	175 psi	4 through 8 inch	Cast iron body	Wafer type Mueller Model A-2102
Butterfly valve	175 psi	4 through 12 inch	Ductile iron EDPM seat	Gear operated Kennedy No. 911

Kennedy valve or Mueller valve figure numbers are used to establish style, quality, and weight.

3. Acceptable manufacturers.
 - a. Crane.
 - b. Jenkins.
 - c. Kennedy.
 - d. Mueller.
 - e. Nibco.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fire Protection Specialty Valves.
 1. Alarm check valves.
 - a. Variable pressure, spring loaded, clapper type.
 - b. Rubber faced clapper, hand hole covers, required trim, and main drain system.
 - c. Moving parts constructed of brass, bronze, stainless steel, or EPDM.
 - d. Design clapper to prevent accumulation of dirt.
 - e. Acceptable manufacturers.
 - 1) GEM
 - 2) Reliable.
 - 3) Victaulic.
 - 4) Viking.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
 2. Dry pipe valves.
 - a. Low differential type with accelerator, automatic air control, including trimmings, filters, air relief valves, regulators, pressure gauges, and drains.
 - b. Acceptable manufacturers.
 - 1) GEM
 - 2) Reliable.
 - 3) Victaulic.

- 4) Viking.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
- 3. Deluge valves.
 - a. Hydraulically operated differential type with flanged inlets and outlets, required trimmings, including pressure gauges, drain connections, and strainers.
 - b. Trim arrangement shall be suitable for Dry Pilot Trim - Pneumatic.
 - c. Acceptable manufacturers.
 - 1) GEM
 - 2) Reliable.
 - 3) Victaulic.
 - 4) Viking.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
- C. Fire Protection Hose Valves and Stations.
 - 1. Class I fire hose valves.
 - a. 2-1/2 inch, heavy-duty angle valve with replaceable stem and valve seat, male outlet threads conforming to local standards, full flow override, designed for 300 psi working pressure.
 - b. Rough brass finish valve body.
 - 1) Furnish polished chrome plated cap and chain for outlet.
 - c. Furnish adjustable, pressure restricting valves, set at 100 psi and having full flow override.
 - d. Acceptable manufacturers.
 - 1) Fire End & Croker Corporation.
 - 2) Guardian Fire Equipment.
 - 3) Potter-Roemer, Model 4085.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Class II hose holder station.
 - a. One steel hose holder with full metal sides and mounting brackets, 12 gauge, red enamel finish.
 - b. One 1-1/2 inch hose valve, 300 psi, angle type, rough brass finished with polished trim.
 - c. 100 feet, 1-1/2 inch single jacket, synthetic, 300 psi hose.
 - d. 2 polished brass rocker lug hose couplings.
 - e. One 1-1/2 inch combination type, adjustable nozzle with bumper ring, red nylon.
 - f. Acceptable manufacturers.
 - 1) Fire End & Croker Corporation.
 - 2) Guardian Fire Equipment.
 - 3) Potter-Roemer, Model 4085.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
 - 3. Fire hose rack station.
 - a. One semiautomatic hose rack, red finish.
 - b. One 1-1/2 inch hose valve, 300 psi, angle type, rough brass.
 - c. One 2-1/2 inch by 1-1/2 inch reducer.
 - d. One 1-1/2 inch hose rack nipple, polished brass.
 - e. 2 rocker lug hose couplings, polished brass.
 - f. One 75 foot length of 300 psi 1-1/2 inch hose, single jacket, synthetic.
 - g. One 1-1/2 inch combination type, adjustable nozzle with bumper ring, red nylon.
 - h. Acceptable manufacturers.
 - 1) Fire End & Croker Corporation.
 - 2) Guardian Fire Equipment.
 - 3) Potter-Roemer, Model 4085.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
 - 4. Class III hose holder station.

- a. One 2-1/2 inch angle valve with cap and chain, rough brass finished with polished trim.
 - b. One 1-1/2 inch hose valve, 300 psi, angle type, rough brass finished with polished trim.
 - c. One steel hose holder, red.
 - d. 100 foot, 1-1/2 inch, single jacket, synthetic, 300 psi hose.
 - e. 2 rocker lug hose couplings, polished brass.
 - f. One 1-1/2 inch combination type, adjustable nozzle with bumper ring, red nylon.
 - g. Acceptable manufacturers.
 - 1) Fire End & Croker Corporation.
 - 2) Guardian Fire Equipment.
 - 3) Potter-Roemer, Model 4085.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- D. Fire Protection Backflow Devices.
- 1. Double Detector Check Valves.
 - a. Corrosion protected, single unit with 2 independent, spring loaded check valves, test cocks, and bypass assembly.
 - b. Bypass assembly includes 2 independent, spring loaded check valves, shutoff valve, test cocks, and low head loss water meter.
 - c. Acceptable products.
 - 1) Cla-Val, Model 16-4.
 - 2) Conbraco, Model 40-600.
 - 3) Watts, Model 709-DCDA.
 - 4) Wilkins, Model 350DA.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
- E. Packaged Fire Protection Valve Cabinet.
- 1. Steel, minimum 14 gauge, powder coated inside and outside.
 - 2. Includes water supply valve, air compressor, preaction valve, alarm pressure switch, supervisory switches, control panel and pressure gauges.
 - 3. Manual pull station mounted on cabinet door.
 - 4. Prewired electrical connections to single point enclosure.
 - 5. Water supply and drain connections from either side of cabinet.
 - 6. Acceptable products.
 - a. Gem, Red-E.
 - b. Reliable, Prepak.
 - c. Victaulic, Fire-Pac.
 - d. Viking, TotalPac.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- F. Fire Department Connections.
- 1. Fire department connection.
 - a. Rough brass finish, standard wall fire department connection with two 2-1/2 inch outlets, and outlet caps and chains.
 - b. Outlet threads to conform with local fire department standard.
 - c. Acceptable products.
 - 1) Badger-Powhatan.
 - 2) Elkhart, 153.
 - 3) Guardian.
 - 4) Potter-Roemer, Fig. 5840.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Wall fire hydrants.
 - a. Rough brass finish, standard wall fire hydrant with two 2-1/2 inch outlets, and outlet caps and chains.
 - b. Outlet threads to conform with local fire department standard.

- c. Acceptable products.
 - 1) Badger-Powhatan.
 - 2) Elkhart, 153.
 - 3) Guardian.
 - 4) Potter-Roemer, Fig. 5840.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
- G. Alarm and Supervisory Devices.
 - 1. Water flow alarm switches.
 - a. Vane type with adjustable retard, suitable for 175 psi working pressures.
 - b. 2 single pole-double throw switches.
 - c. Acceptable products.
 - 1) Potter Electric, Model VSR-F.
 - 2) System Sensor, Model WFD.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Valve supervisory switches.
 - a. Includes cover and tamper screws, with single side conduit entry.
 - b. 2 single pole-double throw switches.
 - c. Acceptable products.
 - 1) Potter Electric, Model VSR-F.
 - 2) System Sensor, Model OSY2 or PIBV2.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
- H. Nameplates.
 - 1. Furnish NFPA 13 approved nameplates for hydraulically designed systems, indicating system designation, area served, and design characteristics.
 - 2. Acceptable product.
 - a. Seton, Style SPH.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- I. Inspector's Test Connections.
 - 1. Includes test pipe and valved connection of not less than 1 inch diameter, terminating in smooth bore, brass outlet, and discharging as indicated.
- J. Sprinkler Heads.
 - 1. Furnish and install sprinkler heads and piping required to make job complete in areas defined in Specification and as designated on drawings.
 - 2. Contract shall be all inclusive and based upon furnishing and installing everything necessary and required for satisfactory and approved installation of fire protection systems, and shall conform with regulations of authorities having jurisdiction.
 - 3. Exposed construction sprinklers.
 - 4. Furnish sprinklers in area indicated, with following temperature rating.
 - a. Exposed construction area: 286 degrees F.
 - 5. Furnish and install as directed by Owner's representative, steel sprinkler emergency cabinets, each containing 12 automatic sprinklers and appropriate wrenches.
 - 6. Stock of extra sprinklers shall include proportionate quantities of types and temperature ratings installed.
 - 7. Total number of spare sprinklers: Not less than 3 percent of total number installed.
 - 8. Acceptable manufacturers.
 - a. ASCOA Fire Systems.
 - b. Gem.
 - c. Reliable.
 - d. Victaulic.
 - e. Viking.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
- K. Pipe Hangers and Supports.

1. Furnish pipe supports and hangers in accordance with requirements specified in Section 21 1008 and as detailed on drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Water Pressure During Construction.
 1. To maintain pressure, temporarily blank off open ends of sprinkler lines or mains from fire protection risers, as installation progresses.
 2. Keep systems not subject to freezing in service during installation shutdown periods.
- B. Pipe Systems.
 1. Install piping and appurtenances in accordance with applicable provisions of Section 21 0500, NFPA 13, ASME B31.1, and requirements of authorities having jurisdiction.
 2. Pitch pipe to drain at riser.
 3. Avoid low or trapped points.
 4. Install discharge drains at each sprinkler riser and where sprinklers are trapped.
 5. Install flanged connections at base of risers, at alarm check valves or dry pipe valves, at fittings where feed mains or cross mains to each floor leave riser or supply main, at feed end of long runs of pipe, and at control valves.
 6. Segmentally welded steel fittings or welded mitered joints will not be accepted.
 7. Where branch is one or more sizes smaller than run, make welded branch connections with standard weight connectors.
 - a. Acceptable products.
 - 1) Weld-o-lets by Bonney Forge and Tool Works.
 - 2) Thread-o-lets by Wheeling Machine Products.
 - 3) Branchlets by Allied Piping Products.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
 8. Where grooved joints are acceptable, install only those grooved couplings and fittings specified.
 9. Substitution of other model, style, size, or rating of couplings, flanges, or fittings is prohibited.
- C. Alarm and Supervisory Devices.
 1. Install and adjust electric water flow alarms to prevent false alarm due to pressure surges within closed sprinkler pipes.
 2. Install alarm bells where indicated.
 3. Install alarm and supervisory devices ready for wiring.
 4. Wiring not included.
 5. Locate inspector's test connections at accessible point not over 7 feet above floor.
 6. In areas of exposed construction, install automatic sprinklers below ductwork and other obstructions, sized over 48 inches in width, in accordance with NFPA 13.
 7. After finish painting, install reflective paint numerals or letters, identifying each automatic sprinkler riser, as directed by Owner.
 8. Install nameplates on hydraulically designed systems.
 9. Install nameplates on automatic sprinkler risers for hydraulically designed systems.
- D. Pipe Hanger and Support.
 1. Install hangers and supports as specified in Section 21 1008 and as detailed on drawings.
 2. Space hangers in accordance with NFPA 13.
 3. Secure supports, for piping under exposed concrete construction, to concrete work with concrete inserts.
 4. Locate inserts on the forms before concrete is poured or use hard cased expansion shields.
 5. Wooden, lead, or plastic plugs used for fastening, are prohibited.

3.02 FIELD QUALITY CONTROL

- A. Test and Acceptance.

1. Test fire protection system in accordance with applicable requirements specified in Section 21 0500 and as specified in this Section.
2. Upon completion of work, notify proper insurance authorities and Owner's representative.
3. Arrange to have authorized inspector in attendance when final job inspections and tests are conducted.
4. All parts of completed sprinkler networks shall be hydrostatically pressure tested at 200 pounds per square inch for minimum 2 hour period.
5. Furnish certificate giving results of each test.
6. Test, flush, and repair aboveground piping in walls, slabs, or sleeves, in presence of insurance authority specified, before concealing.
7. Purge automatic sprinkler systems of trapped air by operating inspector's test connection.
8. Test and actuate electric water flow alarm devices for alarm sensitivity and performance.

END OF SECTION

SECTION 21 1008
HANGERS AND SUPPORTS FOR FIRE PROTECTION

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. AISC (COMM) - Commentary on the Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design; 1989.
- B. AWS D1.1/D1.1 M - Structural Welding Code - Steel; 2010 (Errata 2011).

1.02 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop drawings.
 - a. Pipe hanger and support installation details, including details and locations of seismic or sway bracing, pipe anchors, and anchor bracing.
 - b. Include dimensioned location and method of attachment to building structure.
 - c. Where pipe hangers cannot be hung from building structure, submit proposed method of installing additional structural steel that connects to building structure.

1.03 QUALITY ASSURANCE

- A. Qualifications.
 - 1. Supplemental steel welding procedures, in accordance with section, Qualification, of AWS D1.1.
 - 2. Only welders who have successfully passed examination for this class of work shall be employed to execute structural strength welds.
 - 3. Examination shall have been within past six months, unless welder has been making this type of weld after passing test within two years, as specified under qualification procedures of AWS D1.1.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Adjustable Swivel Ring Hangers.
 - 1. Heavy steel construction with swivel nut and locknut.
 - 2. Acceptable products.
 - a. B-Line, Fig. B3170.
 - b. Carpenter and Paterson, Fig. 800.
 - c. Anvil International Inc., Fig. 70.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Clevis Hangers.
 - 1. Heavy steel with adjustable nut and locknut.
 - 2. Include spreaders on cross bolts of hangers for pipe sized 10 inches and larger.
 - 3. Acceptable products.
 - a. B-Line, Fig. B3100.
 - b. Carpenter and Paterson, Fig. 100.
 - c. Anvil International Inc., Fig. 260.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- C. V-Clevis Hangers.
 - 1. Heavy steel with adjustable nut and locknut.
 - 2. Acceptable products.
 - a. B-Line, Fig. B3106.

- b. Carpenter and Paterson, Fig. 200VT.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- D. Trapeze Hangers.
 - 1. Two-structural channels, back to back, with spacers welded at least on each end, at top and bottom of channels.
 - 2. Size channels with consideration to total weight to be supported, overall span between hanger rods, and so as not to deflect more than 1/240 of span (5/16 inch in 6 feet 3 inches).
 - 3. Assume piping to be supported is full of water.
 - 4. Submit detailed drawings for Architect-Engineer review.
- E. Beam Clamps for Pipe 2 Inches and Smaller.
 - 1. Side type.
 - a. Acceptable products.
 - 1) B-Line: Fig. B3045.
 - 2) Carpenter and Paterson: Fig. 18.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Side I type.
 - a. Acceptable products.
 - 1) Carpenter and Paterson: Fig. 45.
 - 2) B-Line.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
 - 3. Adjustable type.
 - a. Acceptable products.
 - 1) B-Line: Fig. B3040.
 - 2) Carpenter and Paterson: Fig. 14.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
- F. I-Beam Clamps.
 - 1. For pipe sized 2-1/2 through 20 inches, with swing nuts.
 - a. Acceptable products.
 - 1) B-Line: Fig. B3050.
 - 2) Carpenter and Paterson: Fig. 15.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
- G. Beam Clamps.
 - 1. For pipe sized 24 and 30 inches, with weldless eye nuts.
 - a. Acceptable products.
 - 1) B-Line: Fig. B3291 through Fig. B3297.
 - 2) Carpenter and Paterson: Fig. 297.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
- H. Hanger Rods.
 - 1. Threaded, hot rolled, steel rod conforming to ASTM A36 or A575.
 - 2. Hanger rod may be continuously threaded.
 - 3. Use of rod couplings is prohibited.

2.02 MATERIALS

- A. Pipe Hanger and Supporting Materials.
 - 1. Represent minimum requirements for mechanical work in general.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install hanger and supporting materials in accordance with specified requirements, and in accordance with seismic requirements dictated by local codes and governing authorities.
 - 1. Submit typical details and locations for review.

- B. C-clamps without retainer clips and heat-treated spring steel clips that bite into building steel are prohibited as means of fastening pipe hangers to building structure.
- C. Clamps that result in eccentric loads (twisting moments) on structural members of building, except for piping sized 2 inches and smaller, are also prohibited.
- D. Support piping from building structural frame, not from roof deck, permanent metal forms for concrete floors, concrete slabs (unless indicated otherwise), or from other pipe, duct, or equipment.
- E. Contractor's attention is directed to drawing details and building structural framing layout that may require hanger spacing more frequently than spacings shown in table below.
 - 1. Loading at any support point shall not exceed 1000 pounds, unless specifically indicated otherwise.

<u>Pipe Size</u>	<u>Maximum Hanger Spacing</u>	<u>Minimum Rod Size</u>
1 inch and smaller	5 feet	3/8 inch
1-1/4 and 1-1/2 inches	7 feet	3/8 inch
2 inches	10 feet	3/8 inch
2-1/2 through 3-1/2 inches	10 feet	1/2 inch
4 inches	10 feet	5/8 inch

- F. Fire Protection Piping.
 - 1. Smaller than 4 inches: Install adjustable swivel ring type or clevis type hangers.
 - 2. 4 inches and larger: Clevis type hangers.
- G. Pipes Supported Individually From Structural Steel.
 - 1. Support horizontal pipes running perpendicular to steel joists or trusses, building roof purlins or floor beams (not T's) by means of beam clamps.
 - 2. Beam clamps for supporting pipe sized 2 inches and smaller, hung from steel joists or trusses, purlins or floor beams, (not T's) may be one of following.
 - a. Side beam clamp.
 - b. Side I-beam clamp.
 - c. Adjustable beam clamp.
 - 3. Beam clamp size required for given pipe size is scheduled on drawings.
 - 4. Support horizontal pipes running parallel to steel joists or trusses, purlins or floor beams (not T's) as specified above for piping running perpendicular, except where vertical truss member precludes hanging from purlin in concentric manner. Under these circumstances, support piping as specified for trapeze supports.
- H. Trapeze Supports.
 - 1. May be used to support one or more pipes grouped together and hung from building steel as detailed on drawings.
 - 2. Select beam clamp size and corresponding rod size for given trapeze support so as not to exceed loads scheduled on drawings.
 - 3. As option to hanging piping from trapeze support using hanger devices specified, trapeze support below piping may be used as means of support.
 - a. When this option is used, secure pipe to trapeze support with standard U-bolts and locknuts.
- I. Vertical Pipe Supports.
 - 1. Support vertical runs of pipe not subject to appreciable expansion with wrought steel clamps securely clamped to risers.
 - 2. Support and laterally brace at each floor level, but at intervals not to exceed 16 feet.
- J. Where necessary for proper system functioning, brace piping and supports against reaction sway and vibration.
- K. For concentrated loads, such as valves, reduce allowable span proportionately.

- L. Support vertical risers independently of connected horizontal piping whenever practical, with fixed supports at base and at intervals to accommodate system range of load and thermal conditions, and guided for lateral stability.
 - 1. Install only one rigid support for risers subjected to expansion at approximately 1/3 point from top, unless otherwise indicated.
- M. After piping systems have been installed, tested, and placed in satisfactory operation, firmly tighten hanger rod nut and jam nut and upset threads to prevent movement of fasteners.
- N. Welding to Building Structure.
 - 1. Welding to building structure is not allowed, unless otherwise specified or specifically accepted by Architect-Engineer
 - 2. If so specified or accepted, comply with following requirements.
 - a. Unless otherwise noted, welding and workmanship shall be governed by AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings in conjunction with AWS D1.1.
 - b. Allowable stresses in field applied welds using E70 Series and A36 steel.
 - 1) Tension or compression: Same as base metal.
 - 2) Shear: 15,800 pounds per square inch.
 - 3. Surfaces to be welded: Free from loose slag, scale, rust, grease, paint, or other foreign material.
 - 4. Before welding, remove paint from painted surfaces to expose clean steel surface.
 - a. Special attention is called to requirement that maximum size of fillet weld that may be assumed in design of connection shall ensure that stresses in adjacent base material do not exceed allowable value for this material.
 - 5. Welds transmitting calculated stress shall not be less than 3 inches in length, and intermittent welds shall not be less than 2 inches in length.
 - 6. Do not apply welds to flanges of tension members perpendicular to direction of stress.
 - 7. Turn side and end fillet welds around corners for minimum length of twice nominal size of weld.
 - 8. Do not include length of end returns in calculated weld length.
 - 9. Welding or other operation involving use of flame, arcs, or sparking devices will not be allowed without written permission of Owner's Field Representative.
 - 10. Welds found to be in nonconformance to requirements of AWS D1.1 shall be repaired or replaced according to workmanship section of AWS D1.1 without additional cost to Owner.

END OF SECTION

SECTION 22 0523

VALVES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 22 0500 - Common Work Results for Plumbing Systems.
- B. Section 22 0700 - Plumbing Insulation.
- C. Section 22 1010 - Plumbing Systems and Specialties.

1.02 REFERENCE STANDARDS

- A. ASME B31.9 - Building Services Piping; 2011 (ANSI/ASME B31.9).

1.03 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. Product Data.
 - a. For each product and component.

1.04 QUALITY ASSURANCE

- A. Unless otherwise specified, welding procedures and welder or welding operator performance shall be qualified in accordance with ASME B31.9.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 6000 - Product Requirements, for transportation, storage, and handling requirements.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Type GSV-1, General Service Valves.
 - 1. Figure numbers specified, are for purpose of establishing style and quality required.
 - 2. Valves through 2 inches.
 - a. Ball valves: Screwed 150 pound bronze body and ball with Teflon seat and seals, lever handle, Apollo 70-100 Series.
 - 1) Other acceptable manufacturers.
 - (a) Victaulic Company; Series 722.
 - (b) Neles-Jamesbury.
 - (c) Watts.
 - (d) Milwaukee.
 - (e) Nibco.
 - (f) Kitz.
 - (g) Substitutions: See Section 01 6000 - Product Requirements.
 - b. Ball Valves: ANSI Class 150 flanged carbon steel body or 800-psig CWP grooved end ductile iron body, standard port stainless steel ball with Teflon seat and seals, lever handle, Apollo 88-100 Series.
 - 1) Other acceptable manufacturers.
 - (a) Victaulic Company; Series 726.
 - (b) Neles-Jamesbury.
 - (c) Watts.
 - (d) Milwaukee.
 - (e) Nibco.
 - (f) Kitz.
 - (g) Substitutions: See Section 01 6000 - Product Requirements.
 - c. Gate valves: Screwed 150 pound bronze body with solid wedge disc and rising stem, Nibco T-134.

- 1) Other acceptable manufacturers.
 - (a) Watts.
 - (b) Crane.
 - (c) Anvil International, Inc. (Grinnell).
 - (d) Milwaukee.
 - (e) Stockham.
 - (f) Powell.
 - (g) Kitz.
 - (h) Red-White Valve Co.
 - (i) Substitutions: See Section 01 6000 - Product Requirements.
- d. Globe valves: Screwed 150 pound bronze body with oilproof composition disc and rising stem, Nibco T-235-Y.
 - 1) Other acceptable manufacturers.
 - (a) Watts.
 - (b) Crane.
 - (c) Anvil International, Inc. (Grinnell).
 - (d) Milwaukee.
 - (e) Stockham.
 - (f) Powell.
 - (g) Kitz.
 - (h) Red-White Valve Co.
 - (i) Substitutions: See Section 01 6000 - Product Requirements.
- e. Angle valves: Screwed 150 pound bronze body with oilproof composition disc and rising stem, Nibco T-335-Y.
 - 1) Other acceptable manufacturers.
 - (a) Watts.
 - (b) Crane.
 - (c) Anvil International, Inc. (Grinnell).
 - (d) Milwaukee.
 - (e) Stockham.
 - (f) Powell.
 - (g) Kitz.
 - (h) Red-White Valve Co.
 - (i) Substitutions: See Section 01 6000 - Product Requirements.
- f. Check valves: Screwed 200 pound bronze body or grooved end 300-psig ductile iron body, swing type, regrindable seat, Nibco T-453-B.
 - 1) Other acceptable manufacturers.
 - (a) Crane.
 - (b) Keystone.
 - (c) Apco.
 - (d) Victaulic Company; Series 712.
 - (e) Stockham.
 - (f) Powell.
 - (g) Milwaukee
 - (h) Kitz.
 - (i) Substitutions: See Section 01 6000 - Product Requirements.
- g. Note, use of solder joint valves is acceptable for copper piped systems.
- h. Disassemble valves when soldering, as recommended by manufacturer, to prevent damage to internal parts.
3. Valves 2-1/2 inches and larger.
 - a. Ball valves (sizes 2-1/2 inches through 4 inches).
 - 1) Bronze, standard port, screwed, 2-piece body style, stainless steel ball and stem, TFE seats, seals with packing suitable for service, lever handle, Watts Series B-6000.

- 2) Other acceptable manufacturers.
 - (a) Apollo.
 - (b) Milwaukee.
 - (c) Crane.
 - (d) Nibco.
 - (e) Substitutions: See Section 01 6000 - Product Requirements.
 - b. Ball valves (sizes 2-1/2 inches through 6 inches).
 - 1) Ductile iron, standard port, grooved end two-piece body, stainless steel ball and stem, TFE seats, fluoroelastomer seals, suitable for the intended service. Lever handle or gear operator. Victaulic Style 726.
 - 2) Carbon steel, full port, flanged, split body style, ANSI Class 150, stainless steel ball and stem, 15 percent glass filled TFE seats, seals with packing suitable for service, lever handle, Nibco F515-CS-R-66/FS.
 - 3) Other acceptable manufacturers.
 - (a) Apollo.
 - (b) Watts.
 - (c) Milwaukee.
 - (d) Crane.
 - (e) Substitutions: See Section 01 6000 - Product Requirements.
 - c. Gate valves: Flanged 125 pound iron body, bronze trim, outside screw and yoke, renewable seat, wedge disc, Nibco F-617-O.
 - 1) Other acceptable manufacturers.
 - (a) Watts.
 - (b) Crane.
 - (c) Anvil International, Inc. (Grinnell).
 - (d) Stockham.
 - (e) Powell.
 - (f) Milwaukee.
 - (g) Kitz.
 - (h) Substitutions: See Section 01 6000 - Product Requirements.
 - d. Globe valves: Flanged 125 pound iron body, bronze trim, outside screw and yoke, Nibco F-718-B.
 - 1) Other acceptable manufacturers.
 - (a) Watts.
 - (b) Crane.
 - (c) Anvil International, Inc. (Grinnell).
 - (d) Stockham.
 - (e) Powell.
 - (f) Milwaukee
 - (g) Kitz.
 - (h) Substitutions: See Section 01 6000 - Product Requirements.
 - e. Check valves: Grooved end 300-psig ductile iron or flanged 125 pound iron body, stainless steel or bronze trim, renewable seat, suitable for vertical or horizontal installation. Nibco F-918-B.
- B. Drain Valves.
1. Plumbing system drain valves.
 - a. Angle pattern cast brass, chrome plated valve with 3/4 inch iron pipe size female threaded inlet, 3/4 inch outlet with hose-coupling male thread, rising stem, renewable washer, removable tee handle, and lock shield cap.
 - b. Acceptable product.
 - 1) Chicago Faucet, No. 387.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.
 2. General system drain valves.

- a. Angle pattern, cast brass valve with 3/4 inch iron pipe size female threaded inlet, 3/4 inch outlet with hose-coupling male thread, rising stem, renewable washer, and removable tee handle.
- b. Acceptable products.
 - 1) Conbraco, No. 31-200.
 - 2) Nibco, Fig. 73.
 - 3) Watts, BD-4F.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

- A. Valve Tags.
 - 1. 1 inch diameter minimum brass tags fastened to valve by ring and No. 16 brass jack chain, consecutively numbered with 3/8 inch steel stamp.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Valves.
 - 1. Valve stems and other packed joints shall be tight under conditions of actual operation.
 - 2. Repack those found to be leaky with best grade packing.
 - a. Acceptable manufacturers.
 - 1) John Crane.
 - 2) Garlock Packing Company.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
 - 3. Install valves at service connections, at locations indicated on drawings for sectionalizing purposes, and as close to mains as possible.
 - 4. Install pipe nipple and cap on outlet of valves used for sectionalizing.
 - 5. Install stop valves and unions at individual connections to equipment, accessibly located, and arranged to allow easy removal of equipment.
 - 6. Install drain valves at low points of water systems and where water pockets may occur.
 - 7. Where indicated, install chain wheel operators on valves mounted more than 6 feet above working floor level.
 - 8. Label each valve with tag, unless service or function is obvious, as determined by Owner's Representative.
 - 9. Furnish and install framed and glass covered directory of valves, giving number, location, and function of each valve tagged, to Owner.
 - 10. Where it is necessary to operate more than 1 valve in order to control a section of piping, note this fact and numbers of secondary valves on directory.
 - 11. Install grooved end valves in accordance with manufacturer's guidelines and recommendations. Pipe ends shall be clean and free from indentations and projections. Factory trained field representative shall provide on-site training for Contractor's field personnel in installation of grooved end valves. Factory trained representative shall periodically review the product installation. Remove and replace improperly installed products.

END OF SECTION

SECTION 22 0600
BASIC PLUMBING MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 22 0500 - Common Work Results for Plumbing.
- B. Section 22 0523 - Valves.
- C. Section 22 1020 - Special Plumbing Systems.
- D. Section 22 4000 - Plumbing Fixtures

1.02 REFERENCE STANDARDS

- A. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.
- B. ASME B16.3 - Malleable Iron Threaded Fittings; 2011.
- C. ASME B16.4 - Cast Iron Threaded Fittings; 2011.
- D. ASME B16.5 - Pipe Flanges and Flanged Fittings; 2009 (ANSI/ASME B16.5).
- E. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV; 2011.
- F. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2011.
- G. ASME B31.9 - Building Services Piping; 2011 (ANSI/ASME B31.9).
- H. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; 2004 (Reaffirmed 2010).
- I. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2009).
- J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- K. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2009.
- L. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2009.
- M. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings for General-Purpose Piping; 2012.
- N. ASTM A197/A197M - Standard Specification for Cupola Malleable Iron; 2000 (Reapproved 2011).
- O. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2011a.
- P. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2009).
- Q. ASTM A888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011.
- R. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2008.
- S. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2009.
- T. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2011.
- U. AWWA C115/A31.5 - Flanged Ductile Iron Pipe with Threaded Flanges; 2011 (ANSI/AWWA C115/A31.5).
- V. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; 2010 (ANSI/AWWA C600).

1.03 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.

- B. For Review.
 - 1. Shop drawings.
- C. For Closeout.
 - 1. Project Record Documents.
 - a. Piping systems tests.
 - b. Underground piping system.
 - 2. Maintenance data.

1.04 QUALITY ASSURANCE

- A. Qualifications.
 - 1. For pipe welding: Welding procedures and welder or welding operator performance shall be qualified in accordance with ASME B31.9.
 - 2. For supplemental steel welding procedures.
 - a. In accordance with section, Qualification, of AWS D1.1.
 - b. Only welders who have successfully passed examination for this class of work shall be employed to execute structural strength welds.
 - c. Examination shall have been within past 6 months, unless welder has been making this type of weld after passing test within 2 years, as specified under qualification procedures of AWS D1.1.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

1.06 WARRANTY

- A. See Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Underground Corrosion Protection Materials.
- B. Type BS-1, Black Steel Pipe.
 - 1. Pipe.
 - a. 4 inches and smaller: Schedule 40, ASTM A53, black steel.
 - b. 5 through 10 inches: Schedule 40, ASTM A53, black steel, seamless or ERW, Grade B.
 - c. 12 inches and larger: Standard weight, ASTM A53, black steel, seamless or ERW, Grade B.
 - 2. Fittings, screwed: 125 pound, ASTM A126, cast iron.
 - 3. Fittings, butt welded: Standard, ASTM A234, black steel.
 - 4. Screwed unions: 250 pound, ASTM A197, malleable iron ground joint, brass to iron.
 - 5. Screwed couplings: Extra heavy, ASTM A53, black steel with tapered threads.
 - 6. Flanges: 150 pound, ASTM A181, forged steel.
- C. Type COP-1, Copper Tubing.
 - 1. Tubing: Type L, ASTM B88, copper tubing, hard drawn. Furnish annealed tubing where flared or compression fittings are indicated.
 - 2. Socket fittings: 150 pound, ASME B16.22, wrought copper.
 - 3. Flared fittings: ASME B16.26, cast copper alloy.
 - 4. Compression fittings: Brass.
 - a. Acceptable manufacturers.
 - 1) Hoke.
 - 2) Parker-Hannifin.
 - 3) Swagelok.
 - 4) Tylok.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.

- D. Type COP-2, Refrigeration Copper Tubing.
 - 1. Tubing.
 - a. 3/8 inch and smaller: Type L, ASTM B280, copper, seamless, annealed, nitrogenized ACR.
 - b. 1/2 inch and larger: Type L, ASTM B280, copper, seamless, hard drawn, nitrogenized ACR.
 - 2. Flared fittings: 3/8 inch and smaller, ASME B16.26, cast copper alloy, full flow refrigeration type with 45 degree flare.
 - 3. Socket fittings: ASME B16.22, wrought copper.
 - 4. Flanges: 7/8 inch, flange unions, forged steel, flanges, brass tailpieces.
 - a. Acceptable manufacturer.
 - 1) Henry Products.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURED UNITS

- A. Pressure Gauges.
 - 1. Standard, 6 inch, round gauge with cast aluminum case finished in dull black and fitted with chrome plated ring, or stainless steel case and ring, graduations ranging from zero to twice minimum working pressure on line served, and gauge cock.
 - 2. Include brass or steel siphon on pressure gauges for steam lines.
 - 3. Equip pressure gauges installed on pumped lines with pulsation dampeners.
 - 4. Acceptable products.
 - a. Ametek, U.S. Gauge Division: No. 5105-S.
 - b. Ashcroft: No. 1010.
 - c. Terice: No. 600.
 - d. Weiss Instruments: NF6S Series.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- B. Thermometers.
 - 1. Standard cast aluminum case, with manufacturer's standard finish, and complete with liquid filled tube and 9 inch indicating scale.
 - 2. Scale and stem shall be completely adjustable.
 - 3. Furnish brass thermometer wells for thermometers in services with temperatures less than 350 degrees F. Others to be ANSI Type 18-8 stainless steel.
 - 4. Acceptable products.
 - a. Ashcroft: Every Angle No. 200.
 - b. Taylor: Multi-Angle No. 30E.
 - c. Terice: Adjustable Angle No. BX9.
 - d. Weiss Instruments: Vari-Angle 9VS.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- C. Copper Jointing Material.
 - 1. Hard solder.
 - a. Meeting requirements of ASTM B32.
 - b. Alloy containing less than 0.2 percent lead.
 - c. Minimum melting point: 400 degrees F.
 - d. Acceptable product.
 - 1) J.W. Harris: Bridgit.
 - 2) Engelhard Corp.: Silvabrite 100.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Earthwork for Underground Systems.
 - 1. Exclude excavation, shoring, and dewatering from this section.
- B. Pipe Bedding.

1. For granular bedding: Class B.
 - a. Use material as specified in Section 31 0000.
 - b. Spread and compact in accordance with Section 31 0000.
 2. For concrete cradle: Class A.
 - a. Support lower quarter of pipe exterior on continuous concrete cradle.
 - b. Construct of concrete without horizontal construction joints.
 3. For concrete encasement.
 - a. Completely encase pipe in concrete without horizontal construction joints.
- C. Initial Backfill.
1. Material as specified in Section 31 0000.
 2. Material same as used for pipe bedding.
 3. Do not place around concrete for at least 24 hours after concrete placement.
 4. Do not disturb or cause damage to fresh concrete.
 5. Protect pipe and joints from disturbance.
 6. Place in trenches after pipe is in place and tested.
 7. Place within 10 feet of end of last pipe section laid.
 8. Push material from filled end of trench into partially filled section of trench, allowing material to roll down incline onto covered pipe.
 9. Do not push material over side of open trench, allowing clear fall onto partially covered pipe.
 10. Install from pipe bedding to 12 inches above top of highest pipe in trench after compaction.
 11. Spread and compact in accordance with Section 31 0000.
- D. Exclude backfill from top of initial backfill to grade from this section.
- E. Furnish and install bedding and initial backfill for existing pipe exposed during excavation.
- F. Underground Pipe Corrosion Protection.
1. Tape wrap.
 - a. Pipe 3 inches and smaller, and in lengths of 300 linear feet or less.
 - b. Pipe 4 inches and larger, and in lengths of 100 linear feet or less.
 - c. Read manufacturer's instructions before tape is applied.
 - 1) Clean corroded pipe, then prime with primer recommended by tape or sheath manufacturer.
 - 2) Apply tape under warm weather conditions to ensure proper adhesion and in accordance with manufacturer's instructions.
 - 3) Spirally wrap pipe segments, fittings, valves, and connections.
 - 4) Overlap, on successive wrapper passes, minimum of 1/2 width of tape.
 - 5) Cover welded joints with 1 wrap prior to spiral wrapping.
 - 6) Electrical holiday inspection is required for all types.
- G. Underground Pipe.
1. Check each pipe for cracks and defects before placing into position for laying.
 2. Clean jointing surfaces of pipe free from material that may have an injurious effect on joint material used.
 3. Check preplaced joint material for proper position and state required for type of joint specified.
 4. Lay pipe in selected bedding to required line and grade to have firm, even bearing throughout, with close joints and smooth inverts.
 5. Make recesses in bedding, shaped to receive pipe joint or fitting.
 6. Clean foreign matter from interior of each section of pipe before adjoining pipe is laid.
 7. After each section of pipe is laid and joint has been made, fill space between pipes and trench sides with selected bedding.
 8. Protect pipe and joints from disturbance.
 9. Plug open ends of pipe at close of each day's work and when pipes are not being laid.

10. Bituminous coat exposed ferrous surfaces, including bolts and clamps, before burying.
 11. Where underground piping crosses existing sewers, utility pipes, or conduits, take special precautions and protective measures to avoid damage to existing facilities.
 12. Offset pipes where indicated or where required to avoid interference with other work.
 13. Make offsets to deeper elevation to avoid pipe freezing.
 14. Where mechanical joints are allowed, joints utilizing retainer gland with setscrews into pipe surface are prohibited.
 15. Where openings are furnished, install piping through prepared foundation wall openings.
 16. Where necessary to install piping below angle of repose of earth support of foundations, encase pipe and backfill with concrete to line of angle of repose.
 17. For pressure pipe, bends, offsets, tees, crosses, and dead ends, including flange and spigot pieces, shall be suitably rodded and clamped or blocked with concrete thrust blocks.
 18. Rods and clamps shall receive one field coat of bituminous coating after installation.
- H. Aboveground Pipe.
1. Refer to specific piping systems sections for additional requirements.
 2. Install piping in direct, straight, workmanlike manner, concealed where possible, and properly graded.
 3. Particular attention shall be paid to Owner's requirements for clearance.
 4. Conceal piping in finished rooms.
 5. Piping shall not project beyond walls or steel lines, or hang below slabs more than is absolutely necessary.
 6. Fluids shall circulate freely, without noise, and without evidence of leaks, trapping, or air binding.
 7. After installation, clear each section of pipe of debris and obstructions.
 8. Unless indicated otherwise or to facilitate drainage, take branches from top of mains or at 45 degree angle above horizontal.
 9. Valve branch lines to equipment close to main, unless otherwise shown.
 10. Length of pipe used in offsets between risers and mains: Sufficient to facilitate expansion and pitched back to main to furnish proper drainage at all times.
 11. Offset piping to avoid interferences, increase headroom, improve appearance of pipe work, and to properly drain piping, in manner acceptable to Architect-Engineer.
 12. Openings in pipe shall be kept closed during construction with cast iron or malleable iron caps or plugs.
 13. Make pipe connections to allow flexibility of pipe movement during expansion and contraction.
 14. Install piping so strain and weight will not harm equipment at connections.
 15. Install expansion pipe bends where shown or where necessary to allow for proper pipe expansion.
 - a. Construct bends as shown on drawings.
 - b. Spring bends apart during erection approximately 1/2 of length of expected expansion.
 - c. Construct bends so that original cross sections are round and true, without flat spots or buckles.
 - d. Mitered bends in steel pipe systems will not be accepted.
 16. Branch connections for steel pipe.
 - a. Make branch connections with tees, weldolets, or threadolets, where main exceeds branch by two pipe sizes or more.
 - b. Branch connections shall be made with tees, laterals, or crosses, where main and branch are of equal size, or where main exceeds branch by one pipe size.
 - c. Mitered fittings in steel pipe systems will not be accepted.
 17. Install unions at intervals and locations where they will facilitate disconnection and removal of piping, at screwed valves, at connections to equipment, and elsewhere as shown.

18. Install flanged joints at valves, equipment, and other final connections 2-1/2 inches in size and larger.
 19. Flanges: True faced and placed perpendicular to axis of pipe.
 20. Remove raised face of pipe flanges connecting to flat faced, cast iron, flanged valves.
 21. Paint one side of flange gaskets with graphite and oil before placing into position.
 22. Gaskets shall cover full space inside of flange bolt holes, and no part may extend beyond inside diameter of pipe.
 23. Apply pipe thread compound to male threads only.
 24. Install dielectric fittings where dissimilar metal pipes are joined.
 25. Floor and ceiling plates.
 - a. Install where pipes pass through finished floors, walls, ceilings, and partitions.
 - b. Where insulation is carried through pipe sleeve, completely cover insulation and sleeve.
- I. Pipe Welding.
1. Perform steel pipe welding in accordance with ASME B31.9 and applicable requirements of authorities having jurisdiction.
 2. For applicable portions of steam and condensate piping (126 psig and over), boiler feedwater piping, and high temperature hot water heating piping, perform pipe welding in accordance with ASME B31.1.
 3. Pipe ends requiring butt welds.
 - a. Ream free of burrs and bevel 37 degrees, plus or minus 2 degrees.
 - b. Center pipe ends and locate 1/8 inch apart, plus or minus 1/32 inch.
 - c. Before applying welding beads, make not less than 4 equally spaced tack welds between pipe end.
 - d. Clean each bead thoroughly before starting following pass.
 4. Remove welds found to be defective.
 - a. Replace defective welds with nondefective welds to ensure compliance with Contract provisions without additional cost to Owner.
 - b. Peening of defective welds or applying additional beads to defective welds are not acceptable methods of repair.
 5. Furnish fire blankets to protect building structure, services, materials, and equipment.
 6. Furnish and install protective curtains or shields to protect personnel from welder's flash.
- J. Pressure Gauges and Thermometers.
1. Install pressure gauges and thermometer well connections in fittings. Drilling and tapping of pipe wall for connections is prohibited.
 2. Locate gauges and thermometers in accordance with manufacturer's instructions and in visible locations for easy reading from normal operating levels.
- K. General Pipe Testing Requirements.
1. Prior to acceptance of work, test completed piping systems, in accordance with applicable governing codes, and in presence of Owner's Field Representative.
 - a. Furnish necessary equipment and materials, and make necessary test connections required to execute tests.
 - b. Make tests before piping surfaces are concealed or insulated.
 - c. Use standard piping plugs, caps, valves, and blind flanges for sealing off piping for testing.
 - d. Removal of system component, including plugs and caps, to ascertain whether or not test media has reached all parts of system if purging or vent valves are not installed during construction, may be required by Owner's Field Representative.
 - e. Remove components from piping systems during testing whenever component may sustain damage due to test pressure or test media.
 - f. After completion of test, reinstall component and reapply test at component pressure rating.

- g. Check system components and valves for functional operation under system test pressure.
- 2. Pressure tests, when specified, shall be carried out in accordance with ASME B31.9.
- 3. Pressure test steam and condensate (126 psig and higher), high temperature hot water, and boiler feedwater piping systems in accordance with ASME B31.1.
- 4. Take necessary precautions to vent expansive force of compressed air trapped during high pressure hydrostatic testing to preclude injury and damage.
- 5. If testing demonstrates leakage.
 - a. Determine source(s) of leakage, repair or replace defective materials and workmanship, and retest installation until specified requirements are complied with.
 - b. Replace leaking gasket joints with undamaged gaskets and flange bolting.
 - c. Destroy removed gaskets and bolting.
- 6. For hydrostatic tests: Use only potable water.
- 7. Pneumatic testing.
 - a. Use compressed air, carbon dioxide, or nitrogen, unless otherwise specified or accepted.
 - b. Preliminary testing at 5 psi shall require swabbing joints with soap solution and subsequent observation for bubbles.
- 8. Prepare and maintain test records of all piping systems tests.
 - a. List Owner and Contractor personnel present, dates, test gauge identification numbers, ambient temperatures, pressure ranges, rates of pressure drop, and leakage rates.
 - b. Deliver two record copies of acceptance tests to Owner after acceptance.
- 9. Refer to Sections listed under heading, Related Requirements, for requirements specific to individual piping systems.
- L. Flushing and Purging General Requirements.
 - 1. Install temporary and permanent piping, equipment, and materials required for flushing and purging work.
 - 2. Flushing and purging of add-on system into existing system is strictly prohibited.
 - 3. After flushing and purging, remove valves and strainers and clean of debris before replacing.
 - 4. Coordinate cleaning of connections to existing systems through Owner's Field Representative.
 - 5. Flush and purge systems after successful pressure testing.

3.02 FIELD QUALITY CONTROL

- A. Check that pressure, temperature, and flow measuring devices are placed in correct locations. Make modifications to ensure compliance.
- B. Check scale ranges of individual instruments. Expected normal reading shall be near middle of scale. Replace instruments not conforming to this requirement.
- C. Verify that piping systems have been flushed and filled.
- D. Check valve packings. Adjust or replace leaking valve packings.
- E. Verify piping alignment at flexible connections or expansion joints, in hot and cold condition. Correct misalignment, where joints are found to squirm.
- F. Pneumatic test of underground mechanical conduit system shell, with no pressure loss of system when tested at 15 psig.

END OF SECTION

SECTION 22 0700
PLUMBING INSULATION

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 22 0500 - Common Work Results for Plumbing Systems.
- B. Section 22 0600 - Basic Plumbing Materials and Methods.
- C. Section 22 1008 - Hangers and Supports for Plumbing Piping.

1.02 REFERENCE STANDARDS

- A. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2012.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2012c.
- C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2010.

1.03 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. Product data.
 - a. Each product and component.

1.04 WARRANTY

- A. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

1.05 SCHEDULES

- A. Plumbing Piping Insulation.
 - 1. Domestic cold water, indoor.
 - a. Type PP-1 with FF-1, or PP-1 with FF-3. Vapor barrier required.
 - b. Thickness: 1 inch on all size pipe.
 - 2. Domestic cold water, outdoor.
 - a. Type PP-1 with FF-1, or PP-1 with FF-3, all plus JJ-1. Vapor barrier required.
 - b. Thickness: 2 inches on all size pipe.
 - 3. Domestic hot water, indoor.
 - a. Type PP-1 with FF-2, or PP-1 with FF-3.
 - b. Thickness: 1 inch on all pipe 1-1/4 inch and smaller; 1-1/2 inch on all pipe 1-1/2 inch and larger.
 - 4. Domestic hot water, outdoor.
 - a. Type PP-1 with FF-2, or PP-1 with FF-3, all plus JJ-1.
 - b. Thickness: 2 inches on all size pipe.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Drawings indicate equipment locations, related layouts, and general design of systems specified under Division 22.
- B. Include thermal insulation for scheduled systems.
- C. Unless otherwise specified or indicated, insulate surfaces in accordance with insulation schedules specified.

2.02 MATERIALS

- A. General.
 - 1. Include insulating materials having maximum flame spread rating of 25 and maximum smoke developed rating of 50, when tested in accordance with ASTM E84.
 - 2. Preformed fiberglass pipe insulation in accordance with ASTM C547.

3. Insulating materials UL labeled.
- B. Pipe Insulation.
 1. Type PP-1, rigid, molded fiberglass.
 - a. Minimum density: 3-1/2 pounds per cubic foot.
 - b. Thermal conductivity: Not more than 0.26 Btu per hour, per square foot, per degree F, per inch, at mean temperature of 75 degrees F.
 - c. Jacket: Factory applied vapor barrier, with self-sealing laps.
 - d. Laminate: White kraft paper facing exterior.
 - e. Glass fiber reinforcing scrim.
 - f. Aluminum foil facing, with vapor permeance of not more than 0.02 perm when measured in accordance with ASTM E96, Procedure A.
 - g. Acceptable products.
 - 1) Knauf, Fiber Glass ASJ-SSL.
 - 2) Manson, Alley K-SSL.
 - 3) Manville, Micro-Loc 650 AP-T.
 - 4) Owens-Corning, Fiberglas 25 ASJ-SSL-II.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
- C. Fittings Insulation.
 1. Type FF-1, fiberglass blanket or preformed segmented.
 - a. Density: 1 pound per cubic foot.
 - b. Thermal conductivity: Not more than 0.28 Btu per hour, per square foot, per degree F, per inch, at mean temperature of 75 degrees F.
 - c. Vapor barrier coating.
 2. Type FF-2, fiberglass blanket or preformed segmented.
 - a. Density: 1 pound per cubic foot.
 - b. Thermal conductivity: Not more than 0.28 Btu per hour, per square foot, per degree F, per inch, at mean temperature of 75 degrees F.
 3. Type FF-3, premolded, one-piece, PVC insulated fitting covers.
 - a. Factory precut fiberglass insulation segments.
 - b. Flexible, self-extinguishing PVC cover: Flame spread classification, not more than 25. Fuel contribution: Not more than 25, as tested in accordance with ASTM E84.
 - c. Acceptable products.
 - 1) Accessible Products, 300 Series Thermazip.
 - 2) Ceel Company, Ceel-Tite 300.
 - 3) Coverite, S-800.
 - 4) Knauf, Proto.
 - 5) Manville, Zeston.
 - 6) Substitutions: See Section 01 6000 - Product Requirements.
- D. Jacketing.
 1. Type JJ-1, 3003 or 5005 aluminum roll.
 - a. Protect insulating material. Integral vapor barrier coating on insulation side.
 - b. Round jacketing, minimum thickness: 0.016 inch.
 - 1) Locked longitudinal seams.
 - 2) Butt circumferential joints.
 - 3) Butt straps and stainless steel draw bands.
 - 4) Include butt straps with high temperature resistant weatherproof sealant.
 - c. Rectangular jacketing, minimum thickness: 0.032 inch.
 - d. Acceptable products.
 - 1) Childers, Lock-On, Ell-Jacs and Tee-Jacs.
 - 2) Pabco, Surefit.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
- E. Cements, Adhesives, and Coatings.
 1. Insulating and finishing cement.

- a. Acceptable products.
 - 1) Celotex, MW-1.
 - 2) Pabco, Pabcote.
 - 3) Fibrex, FBX Superkote.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- 2. Lap adhesive and finish coating for nonvapor barrier applications.
 - a. Acceptable products.
 - 1) Childers, CP-50A.
 - 2) Foster, 30-04.
 - 3) Marathon, 102.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- 3. Vapor barrier lap adhesive and surfacing adhesive.
 - a. Acceptable products.
 - 1) Childers, CP-82.
 - 2) Foster, 85-20.
 - 3) Marathon, 225.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- 4. Vapor barrier coatings.
 - a. Acceptable products.
 - 1) Marathon, 501.
 - 2) Childers, CP-30 or CP-32.
 - 3) Foster, 30-35.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General Requirements.
 - 1. Install to present a neat, clean appearance.
 - 2. Apply only after surfaces have been cleaned, inspected, and tested.
 - 3. Apply neatly, tightly, with unbroken lengths, and with ends of sections firmly butted together.
 - 4. At joints, lap insulating jackets and cement in position.
 - 5. Sectional covering shall be uniform.
 - 6. Where required material thickness is not available, layer insulation, staggering butt joints.
 - 7. Do not dilute surface finishes and adhesives.
 - 8. Apply surface finishes and adhesives in accordance with manufacturer's instructions.
 - 9. Unless otherwise specified, do not apply second or multiple coats until previous coats have thoroughly dried.
 - 10. Maintain integrity of vapor barriers. Do not use fasteners to secure vapor barrier insulation, which penetrate or damage vapor barrier.
 - 11. Butt insulation to building construction and to angle iron stops. Where vapor seals or similar facings are required, extend and seal to building construction or angle.
 - 12. Restore to original likeness existing insulation damaged during progress of work.
- B. Pipe and Fittings Insulation.
 - 1. General application notes.
 - a. Insulate each pipe individually. Gang insulation of piping groups is unacceptable.
 - b. Place longitudinal joints on least conspicuous side of pipe.
 - c. Extend insulation on piping through sleeves.
 - d. Install insulation to conform to a uniform diameter.
 - e. Insulate fittings, flanges, and valves to thickness equal to insulation on adjacent piping.
 - f. Omit insulation on rubber expansion joints and rubber vibration isolation joints of hot water services.

- g. At uncovered joints and fittings: Taper ends of insulation with cement before wrapping. Construct tapered ends adjacent to bolted joints to permit removal of bolts without damaging insulation.
 - h. Seal insulation and jacketing cut during installation of pipe anchors, with insulating cement.
 - 2. Type PP-1 insulation.
 - a. Install insulation and seal longitudinal, self-sealing laps in accordance with manufacturer's instructions.
 - b. Where vapor barrier is required, wrap circumferential joints with vapor barrier pressure sensitive adhesive tape, overlapping insulation by 2 inches.
 - 3. Type FF-1 insulation.
 - a. Insulate fittings, flanges, and valves to a thickness equal to covering on adjacent piping.
 - b. Where preformed, segmented pipe type insulation is used, secure insulation with 20 gauge galvanized steel wire.
 - c. Cover blanket or segmented insulation with a smooth coat of insulating cement.
 - d. Over the coat of insulating cement, apply a layer of open weave glass cloth fabric, embedded between 2 flood coats of vapor barrier coating.
 - e. Overlap fabric not less than 2 inches onto adjacent pipe insulation.
 - 4. Type FF-2 insulation.
 - a. Insulate fittings, flanges and valves to a thickness equal to covering on adjacent piping.
 - b. Where preformed, segmented pipe type insulation is used, secure insulation with 20 gauge galvanized steel wire.
 - c. Cover blanket or segmented insulation with a smooth coat of insulating cement.
 - d. Over the coat of insulating cement, apply a finish coat.
 - 5. Type FF-3 insulation.
 - a. Where insulation system requires a vapor barrier: Seal edges of cover with a vapor barrier coating. Wrap circumferential joints with a vapor barrier pressure sensitive adhesive tape. Overlap adjacent pipe insulation by at least 2 inches.
 - b. Where insulation system does not require a vapor barrier: Apply adhesive. Staple, tack fasten, or tape cover to adjacent pipe covering as recommended by manufacturer. Overlap adjacent pipe insulation by at least 2 inches.
- C. Jacketing.
 - 1. Type JJ-1.
 - a. Install round jacketing and attach butt straps and draw bands in accordance with manufacturer's instructions.
 - b. Lap rectangular jacketing not less than 2 inches on longitudinal and transverse joints. Lap top jacketing over side jacketing. Seal joints with manufacturer's standard weather and heat resistant sealant. Attach jacketing with stainless steel sheet metal screws and lead washers, or galvanized angle iron hoops.

END OF SECTION

SECTION 22 1008
HANGERS AND SUPPORTS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop drawings.
 - a. Pipe hanger and support installation details, including details and locations of seismic or sway bracing, pipe anchors, and anchor bracing.
 - b. Include dimensioned location and method of attachment to building structure.
 - c. Where pipe hangers cannot be hung from building structure, submit proposed method of installing additional structural steel that connects to building structure.

1.02 QUALITY ASSURANCE

- A. Qualifications.
 - 1. Supplemental steel welding procedures, in accordance with section, Qualification, of AWS D1.1.
 - 2. Only welders who have successfully passed examination for this class of work shall be employed to execute structural strength welds.
 - 3. Examination shall have been within the past six months, unless welder has been making this type of weld after passing test within two years, as specified under qualification procedures of AWS D1.1.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pipe Hanger and Supporting Materials.
 - 1. Represent minimum requirements for mechanical work in general.

2.02 MANUFACTURED UNITS

- A. Adjustable Swivel Ring Hangers.
 - 1. Heavy steel construction with swivel nut and locknut.
 - 2. Acceptable products.
 - a. B-Line, Fig. B3170.
 - b. Carpenter and Paterson, Fig. 800.
 - c. Anvil International Inc., Fig. 70.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Clevis Hangers.
 - 1. Heavy steel with adjustable nut and locknut.
 - 2. Include spreaders on cross bolts of hangers for pipe sized 10 inches and larger.
 - 3. Acceptable products.
 - a. B-Line, Fig. B3100.
 - b. Carpenter and Paterson, Fig. 100.
 - c. Anvil International Inc., Fig. 260.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- C. V-Clevis Hangers.
 - 1. Heavy steel with adjustable nut and locknut.
 - 2. Acceptable products.
 - a. B-Line, Fig. B3106.
 - b. Carpenter and Paterson, Fig. 200VT.

- c. Substitutions: See Section 01 6000 - Product Requirements.
- D. Single-Rod Roller Hanger.
 - 1. Steel frame, cast iron roller, and steel roller rod.
 - 2. Acceptable products.
 - a. B-Line, Fig. B3110.
 - b. Carpenter and Paterson Fig. 140.
 - c. Anvil International Inc., Fig. 181.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- E. Two-Rod Roller Hanger.
 - 1. Cast iron roller, steel roller rod, and malleable iron or cast iron sockets, without hanger rod.
 - 2. Acceptable products.
 - a. B-Line, Fig. B3114.
 - b. Carpenter and Paterson, Fig. 142.
 - c. Anvil International Inc., Fig. 171.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- F. Adjustable, Two-Rod Roller Hanger.
 - 1. Cast iron roller, steel roller rod, malleable iron or cast iron sockets, and threaded hanger rods with nuts.
 - 2. Acceptable products.
 - a. B-Line, Fig. B3122.
 - b. Carpenter and Paterson, Fig. 109.
 - c. Anvil International Inc., Fig. 177.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- G. Protection Shields.
 - 1. Minimum 18 gauge thick, 180 degree, galvanized steel shield with flared ends and centering ribs.
- H. Preinsulated Hanger Inserts.
 - 1. Hanger inserts consist of two 180 degree segments of 100 psi average compressive strength insulation of same thickness as adjoining pipe insulation.
 - a. Where manufacturer recommends or drawings indicate, include wedge shaped insert in bottom half, consisting of 600 psi minimum compressive strength calcium silicate.
 - b. Length of hanger insert is scheduled on drawings.
 - 2. Protect each half of hanger insert by adhering galvanized sheet metal shield to saddle.
 - a. Shield length and gauge thickness is scheduled on drawings.
 - b. Where indicated or recommended by manufacturer, include heavy-duty load bearing plate on bottom of metal shield.
 - c. Area of high density insert and pipe bearing support surface of shield shall be as scheduled on drawings or as recommended by manufacturer.
 - d. Acceptable products.
 - 1) American Mechanical Insulation Sales Inc.: AMIS 200 Calmax.
 - 2) B-Line: Figures B3380 through B3384.
 - 3) Carpenter and Paterson: 465 CVB.
 - 4) Pipe Shields Incorporated: Series A1000 through A9000.
 - 5) Value Engineered Products, Inc.: Pro-Shield Series.
 - 6) Substitutions: See Section 01 6000 - Product Requirements.
 - 3. For insulated copper pipe with Type PP-2 insulation, use preinsulated hanger inserts as manufactured by Klo-Sure.
- I. Trapeze Hangers.
 - 1. Two-structural channels, back to back, with spacers welded at least on each end, at top and bottom of channels.

2. Size channels with consideration to total weight to be supported, overall span between hanger rods, and so as not to deflect more than 1/240 of span (5/16 inch in 6 feet 3 inches).
 3. Assume piping to be supported is full of water.
 4. Submit detailed drawings for Architect-Engineer review.
- J. Beam Clamps for Pipe 2 Inches and Smaller.
1. Side type.
 - a. Acceptable products.
 - 1) B-Line: Fig. B3045.
 - 2) Carpenter and Paterson: Fig. 18.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
 2. Side I type.
 - a. Acceptable products.
 - 1) Carpenter and Paterson: Fig. 45.
 - 2) B-Line: Fig. 225.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
 3. Adjustable type.
 - a. Acceptable products.
 - 1) B-Line: Fig. B3040.
 - 2) Carpenter and Paterson: Fig. 14.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
- K. I-Beam Clamps.
1. For pipe sized 2-1/2 through 20 inches, with swing nuts.
 - a. Acceptable products.
 - 1) B-Line: Fig. B3050.
 - 2) Carpenter and Paterson: Fig. 15.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
- L. Beam Clamps.
1. For pipe sized 24 and 30 inches, with weldless eye nuts.
 - a. Acceptable products.
 - 1) B-Line: Fig. B3291 through Fig. B3297.
 - 2) Carpenter and Paterson: Fig. 297.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
- M. Hanger Rods.
1. Threaded, hot rolled, steel rod conforming to ASTM A36 or A575.
 2. Hanger rod may be continuously threaded.
 3. Use of rod couplings is prohibited.
- N. Uninsulated pipe and insulated pipe without vapor barrier shall be supported by Type 1 or Type 3 attachments, except as otherwise specified or indicated.
- O. Insulated and vapor sealed piping support shall be combination of Type 1 attachment and shields which employ high density, inorganic inserts and integral vapor barrier provisions.
- P. Parallel and Single Pipes.
1. Fabricate trapeze hangers from structural steel shapes complying with Supplementary Steel requirements, or support may be of commercially available, proprietary design, rolled steel.
 2. Refer to applicable requirements for single pipes.
 3. Pipe Shields, Incorporated, 360 degree shields may be used on trapeze hangers where Type 24 U-bolts are indicated.
- Q. Vertical Pipe Attachments, Type 8, Spring Type.
- R. Sliding/Guiding Devices.

1. Pre-engineered, commercially available products, with published load ratings constructed to include graphite members in sliding contact with AISI Type 300 Series stainless steel.
 2. Protect assembly from dirt intrusion and prevent line contact of sliding surfaces.
 3. Acceptable manufacturers.
 - a. F and S Manufacturing Corporation.
- S. Alignment Guides.
1. Factory fabricated unit consisting of bolted semisteel (cast iron) spider and bolted guiding cylinder, with supporting legs welded to pipe support.
 2. Acceptable products.
 - a. American District Steam Company (ADSCO): Model H.
 - b. Keflex: Type MM.
 - c. Tube Turn, Division of Chemetron Corporation: Series A.
 - d. U.S. Flexible Metallic Tubing Company.
 3. Hanger rods and connectors.
 - a. Connect hanger rods to center loading hanger type beam clamps, concrete inserts, or expansion shields.
 - b. Underwriters Laboratories listed.
 - c. Use only circular cross-section rod hangers to connect building structure attachments to pipe support devices.
 - d. Pipe or bars of equivalent strength may be used for hangers.
 - e. Employ turnbuckles, swing eyes, and clevises.
 - f. Rod couplings are not acceptable.
 4. Supplementary steel.
 - a. Design and fabricate supplementary steel in accordance with AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install hanger and supporting materials in accordance with specified requirements, and in accordance with seismic requirements dictated by local codes and governing authorities.
 1. Submit typical details and locations for review.
- B. C-clamps without retainer clips and heat-treated spring steel clips that bite into building steel are prohibited as means of fastening pipe hangers to building structure.
- C. Clamps that result in eccentric loads (twisting moments) on structural members of building, except for piping sized 2 inches and smaller, are also prohibited.
- D. Support piping from building structural frame, not from roof deck, permanent metal forms for concrete floors, concrete slab (unless indicated otherwise), or from other pipe, duct, or equipment.
- E. Install hangers for non-vertical conductors, sized to accommodate future installation of 1 inch minimum insulation.
 1. Hanger rods shall be long enough to allow lowering of hangers by 1 inch during insulation installation.

Screwed or welded steel pipe (liquid or vapor)

<u>Pipe Size</u>	<u>Maximum Hanger Spacing</u>	<u>Minimum Rod Size</u>
1/2 to 1 inch	8 feet	3/8 inch
1-1/4 through 2 inches	10 feet	3/8 inch
2-1/2 to 3-1/2 inches	12 feet	1/2 inch
4 and 5 inches	16 feet	5/8 inch
6 inches	16 feet	3/4 inch
8 and 12 inches	XX feet	X inch
14 and 16 inches	XX feet	X inch
18 and 20 inches	XX feet	X inch
24 and 30 inches	XX feet	X inches

F. Uninsulated Piping.

1. Smaller than 4 inches: Install adjustable swivel ring type or clevis type hangers.
2. 4 inches and larger: Clevis type hangers.

G. Insulated Piping.

1. Smaller than 4 inches: Install adjustable swivel ring or clevis type hangers with pre-insulated hanger insert.
2. Cold pipe 4 inches and larger: Install clevis type hangers with pre-insulated hanger insert.
3. Hot pipe 4 and 5 inches: Install single-rod roller type hangers with pre-insulated hanger insert.
4. Hot pipe 6 inches and larger: Install 2-rod roller type hangers with pre-insulated hanger insert.
5. On roof, sized 1 inch and larger: Install pipe rolls with pre-insulated hanger insert.

H. Pipes Supported Individually From Structural Steel.

1. Support horizontal pipes running perpendicular to steel joists or trusses, building roof purlins or floor beams (not T's) by means of beam clamps.
2. Beam clamps for supporting pipe sized 2 inches and smaller, hung from steel joists or trusses, purlins or floor beams, (not T's) may be one of following.
 - a. Side beam clamp.
 - b. Side I-beam clamp.
 - c. Adjustable beam clamp.
3. Beam clamp size required for given pipe size is scheduled on drawings.
4. Support horizontal pipes running parallel to steel joists or trusses, purlins or floor beams (not T's) as specified above for piping running perpendicular, except where vertical truss member precludes hanging from purlin in concentric manner. Under these circumstances, piping shall be supported as specified for trapeze supports.

I. Trapeze Supports.

1. Trapeze supports may be used to support one or more pipes grouped together and hung from building steel as detailed on drawings.
2. Select beam clamp size and corresponding rod size for given trapeze support so as not to exceed loads scheduled on drawings.
3. As option to hanging piping from trapeze support using hanger devices specified, trapeze support below piping may be used as means of support.
 - a. When this option is used, uninsulated pipe shall be secured to trapeze support with standard U-bolts and locknuts.
4. Install insulated cold pipe with insulating saddle and shield, and secure it to trapeze support with standard U-bolt and locknut.
5. Cradle insulated hot pipe in an adjustable cast iron roller support.

J. Vertical Pipe Supports.

1. Support vertical runs of uninsulated or insulated cold pipe not subject to appreciable expansion with wrought steel clamps securely clamped to risers.

2. Support insulated hot pipe subject to vertical expansion by same wrought steel clamp, securely clamped to riser and attached to springs to absorb vertical deflection without appreciable loss of supporting effort.
 3. Support and laterally brace at each floor level, but at intervals not to exceed 16 feet.
- K. Where necessary for proper system functioning, brace piping and supports against reaction sway and vibration.
- L. For concentrated loads, such as valves, reduce allowable span proportionately.
- M. Support vertical risers independently of connected horizontal piping whenever practical, with fixed or spring supports at base and at intervals to accommodate system range of load and thermal conditions. Use guides for lateral stability.
1. Only one rigid support shall be installed for risers subjected to expansion at approximately 1/3 point from top, unless otherwise indicated.
 2. For horizontal piping contiguous to moving risers, two supports nearest to riser shall be spring supports, unless otherwise indicated.
- N. After piping systems have been installed, tested, and placed in satisfactory operation, firmly tighten hanger rod nut and jam nut and upset threads to prevent movement of fasteners.
- O. Welding to Building Structure.
1. Welding to building structure is not allowed, unless otherwise specified or specifically accepted by Architect-Engineer
 2. If so specified or accepted, comply with following requirements.
 - a. Unless otherwise noted, welding and workmanship shall be governed by AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings in conjunction with AWS D1.1.
 - b. Allowable stresses in field applied welds using E70 Series and A36 steel.
 - 1) Tension or compression, same as base metal.
 - (a) Shear: 15,800 pounds per square inch.
- P. Surfaces to be welded shall be free from loose slag, scale, rust, grease, paint, or other foreign material.
- Q. Before welding, painted surfaces shall have paint removed to expose clean steel surface.
1. Special attention is called to requirement that maximum size of fillet weld that may be assumed in design of connection shall ensure that stresses in adjacent base material do not exceed allowable value for this material.
- R. No welds transmitting calculated stress shall be less than 3 inches in length, and no intermittent welds shall be less than 2 inches in length.
- S. Do not apply welds to flanges of tension members perpendicular to direction of stress.
- T. Turn side and end fillet welds around corners for minimum length of twice nominal size of weld.
- U. Length of end returns is not to be included in calculated weld length.
- V. Welding or other operation involving use of flame, arcs, or sparking devices will not be allowed without written permission of Owner's Field Representative.
- W. Welds found to be in nonconformance to requirements of AWS D1.1 shall be repaired or replaced according to workmanship section of AWS D1.1 without additional cost to Owner.

END OF SECTION

SECTION 22 1010
PLUMBING SYSTEMS AND SPECIALTIES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 22 0600 - Basic Plumbing Materials and Methods.
- B. Section 22 0700 - Plumbing Insulation.
- C. Section 22 4000 - Plumbing Fixtures.
- D. Division 31 and 33, Earthwork and Utilities.

1.02 REFERENCE STANDARDS

- A. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; 2009 (ANSI/ASSE 1012).
- B. ASSE 1017 - Temperature Actuated Mixing Valves for Hot Water Distribution; 2009.
- C. ASSE 1020 - Performance Requirements for Pressure Vacuum Breaker Assembly, (Recommended for Outdoor Usage); 2004 and Errata.
- D. AWWA C651 - Disinfecting Water Mains; 2005 (ANSI/AWWA C651).
- E. PDI-WH 201 - Water Hammer Arresters; 2010.

1.03 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Closeout.
 - 1. Project Record Documents.
 - 2. Certificates.
 - a. PDI Standard WH 201 Certification of water hammer absorber.
 - 3. Test Reports.
 - a. Potable Water System Disinfection Report.
 - b. Backflow Prevention Device Test Report.

1.04 QUALITY ASSURANCE

- A. Quality control provisions of Division 01, General Requirements, apply to this Section.
- B. Reviews and acceptance, except as required for field installation, field applications, and field tests shall be obtained before delivery of items of material, equipment, or systems to project site.

1.05 WARRANTY

- A. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 SYSTEMS

- A. Underground Piping.
 - 1. Sanitary drainage.
 - a. Pipe.
 - 1) Type CISP-NH, cast iron soil pipe, no hub with 4 band mechanical clamps, for pipe sized 3 inches and larger.
 - 2. Cold water.
 - a. Pipe.
 - 1) Type COP-3, copper tubing for pipe sized 2-1/2 inches and smaller.
 - 2) Type DIWP, ductile iron water pipe for pipe sized 3 inches and larger.
 - b. Joints.
 - 1) Copper, soldered, using silver solder.
 - 2) Ductile iron water pipe Slip-on or mechanical type using Type BOLT4 bolting

- B. Aboveground Piping.
 - 1. Sanitary drainage and vents.
 - a. Pipe.
 - 1) Type CISP-NH, cast iron soil pipe, no hub with 4 band mechanical clamps.
 - 2. Cold water.
 - a. Pipe.
 - 1) Type COP-1, copper tubing for all pipe sizes.
 - b. Joints.
 - 1) Copper: Soldered, using hard solder.
 - c. Valves: Type GSV-1, general service valves.
 - 3. Hot water.
 - a. Pipe.
 - 1) Type COP-1, copper tubing for all pipe sizes.
 - b. Joints.
 - 1) Copper: Soldered, using hard solder.
 - c. Valves: Type GSV-1, general service valves.

2.02 MANUFACTURED UNITS

- A. Water Hammer Absorbers.
 - 1. Air chamber type.
 - a. Upright, capped pipe extensions, minimum 18 inches long and 1 pipe size larger than connected pipe.
 - 2. Mechanical type.
 - a. Precharged and permanently sealed, expansion bellows type absorbers with Type 18-8 stainless steel, or spun seamless Type L copper shell and corrosion resistant bellows.
 - b. Absorbers sized 1 inch and smaller certified in accordance with PDI WH 201.
 - c. Acceptable products.
 - 1) Metraflex, Surgemaster.
 - 2) Mifab, MWH Series.
 - 3) J.R. Smith, Hydrotrol Series.
 - 4) Sioux Chief Mfg., Hydra-Rester, Mega-Rester, and Mini-Rester.
 - 5) Zurn, Shoktrol Series.
 - 6) Substitutions: See Section 01 6000 - Product Requirements.
- B. Backflow Prevention Devices.
 - 1. Pressure type vacuum breaker.
 - a. In accordance with ASSE 1020, consisting of spring loaded, single float and disc with independent first check, complete with shutoff valves and ball type test cocks.
 - b. Acceptable products.
 - 1) Conbraco, Series 40-500.
 - 2) Febco, Model 765.
 - 3) Watts, 800 Series.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- C. Hose Bibbs.
 - 1. Angle pattern, with rough chrome plated cast brass body, 3/4 inch female threaded inlet, 3/4 inch outlet with hose coupling male thread, rising stem, renewable washer, removable tee handle, lock shield cap, and vacuum breaker.
 - 2. Acceptable products.
 - a. Chicago Faucet, No. 387 LF with E27.
 - b. Mifab, MHY-9141.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- D. Wall Hydrants.

1. Key-operated nonfreeze type, complete with vacuum breaker, wall box suitable for wall thickness, and union elbow.
 2. Wall hydrants include bronze hydrant head casing and valve housing, complete with vacuum breaker, 3/4 inch hose outlet, and enclosed in flush mounted, bronze box with polished nickel bronze face and cover.
 3. Acceptable products.
 - a. J.R. Smith, 5509.
 - b. Mifab, MHY-20 Series.
 - c. Wade, W-8625.
 - d. Zurn, Z-1300.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- E. Floor Drains.
1. Drains shall include seepage flanges, weepholes, and flashing collars or clamps.
 2. Unless otherwise indicated, drains include traps and bottom outlet caulk connections.
 3. Manufacturer series numbers for following floor drains represent basic style required and do not necessarily include all modifications for sizes or options specified.
 4. Series FD-1, light duty floor drains: Consist of painted cast iron bodies with reversible flashing collars, and grates, strainers, and accessories as specified.
 - a. Type FD-1A, floor drain.
 - 1) Adjustable, 7 inch round, nickel bronze strainer with hinged grate.
 - 2) Acceptable products.
 - (a) J.R. Smith, 2010-A-H.
 - (b) Zurn, Z-415-C.
 - (c) Josam, 30000-H.
 - (d) Substitutions: See Section 01 6000 - Product Requirements.
 - b. Type FD-1B, floor drain.
 - 1) Adjustable, 6 inch square, nickel bronze strainer with hinged grate.
 - 2) Acceptable products.
 - (a) J.R. Smith, 2010-B-H.
 - (b) Wade, W-1100-N.
 - (c) Zurn, Z-415-SH.
 - (d) Josam, 30000-T.
 - (e) Substitutions: See Section 01 6000 - Product Requirements.
- F. Trap Primer System.
1. Furnish trap primer system, consisting of trap primer valve, trap primer distribution units, and manifold piping as required.
 2. Acceptable manufacturers.
 - a. Precision Plumbing Products, Inc.
 - b. Mifab.
 - c. J.R. Smith.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- G. Cleanouts.
1. Size cleanouts for aboveground piping.
 - a. Sized 4 inches and smaller, same as pipe they serve.
 - b. For larger size piping, size cleanout 4 inches minimum.
 2. Size cleanouts for underground piping.
 - a. Sized 6 inches and smaller, same as pipe they serve.
 - b. For larger size piping, size cleanout 6 inches minimum.
 3. Furnish cleanouts having painted cast iron bodies and bronze plugs with tapered threads.
 4. Cleanouts on grade shall include spigot outlets and flashing flange device.
 5. Cleanouts in upper level floors shall include inside caulk outlets, flashing flange device, and flashing clamp.

6. Manufacturer series numbers for following cleanouts represent basic style required and do not necessarily include all modifications for sizes or options specified.
7. Type CO-W1, wall cleanout.
 - a. Cleanout tee with countersunk head plug, and square cover and frame.
 - b. Cleanouts installed in tiled wall shall include chrome plated covers.
 - c. Acceptable products.
 - 1) J.R. Smith, 4558.
 - 2) Wade, W-8460-S.
 - 3) Zurn, Z-1447.
 - 4) Josam, 58770.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
8. Type CO-F1, floor cleanout.
 - a. Round cleanout with adjustable, nickel bronze, scoriated top and carpet marker.
 - b. Acceptable products.
 - 1) J.R. Smith, 4023/4028.
 - 2) Wade, W-6000/W-6010.
 - 3) Zurn, ZN-1400 NH.
 - 4) Josam, 56010-14-Z.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
- H. Downspout Nozzle.
 1. Sized as indicated on drawings.
 2. Cast bronze body with loose wall flange and threaded inlet connection.
 3. Acceptable products.
 - a. Josam, 25010 Series.
 - b. J.R. Smith, 1770.
 - c. Mifab, R1940 Series.
 - d. Wade, W-3940.
 - e. Zurn, Z-199.
 - f. Substitutions: See Section 01 6000 - Product Requirements.

2.03 MATERIALS

- A. Piping Schedules and Accessories.
 1. Refer to Section 22 0600 for pipe schedules, general service valves, and related accessory requirements for plumbing systems specified.
- B. Bedding and Backfill.
 1. Refer to Division 31 and 33 for earthwork, bedding, and backfilling requirements.
- C. Manhole Materials.
 1. Manhole steps.
 - a. Nonslip steps conforming to OSHA and ASTM C478.
 2. Base slab.
 - a. Reinforced, poured-in-place, or precast concrete.
 - b. Minimum slab thickness: 8 inches, with minimum No. 5 reinforcing bars at 8 inches on center each way.
 - c. Precast slabs shall have reinforcing in accordance with ASTM C478.
 - d. Compressive strength of concrete: 4000 psi at 28 days.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Underground Systems.
 1. Refer to Section 22 0600 for additional underground piping systems installation requirements.
 2. Unless otherwise indicated or specified, underground gravity drainage pipe specified in this Section includes pipe inside building and runs to 5 feet outside building perimeter.

- B. Manholes.
 - 1. Cast poured-in-place base slabs on earth subgrade.
 - 2. Place precast concrete base slabs on compacted leveling course of sand, not less than 3 inches thick.
 - 3. Level manhole frames, anchor and grout them to top of manholes.
 - 4. Set manhole tops flush with finished grade, floor, or pavement.
 - 5. Install 3 courses of brick between cone and frame.
 - 6. Lay up brick with sand-cement mortar.
 - 7. Fill annular air spaces at pipe openings with manhole adapters and nonshrink mortar.
 - 8. Where plugged openings for future connections in manholes are indicated, install 3 foot length of pipe, fitted with bulkhead cap equal in strength to side walls of pipe.
- C. Aboveground Piping Systems.
 - 1. Refer to Section 22 0600 for additional aboveground piping systems installation, testing, and flushing requirements.
 - 2. Pitch horizontal drainage lines downward in direction of flow, not less than 1/8 inch per foot.
 - 3. Align eccentric reducers in water lines so pipe sections are flush at top.
 - 4. Exposed chrome plated piping around fixtures shall not show tool marks or threads at fittings.
 - 5. Regulate flow of water to each fixture so faucets operate satisfactorily without waste of water or objectionable noise.
 - 6. Where possible, recess vertical conductors within channels of building columns, or set them tight against building walls.
 - 7. Install vent piping required by code, as shown on drawings, or necessary to prevent siphonage or back pressure on traps.
 - 8. Make offsets in vent pipes at angle of not less than 45 degrees to horizontal, where possible.
 - 9. Extend vent pipes 2 feet above roof.
 - 10. Increase vent pipes less than 4 inches in diameter to 4 inches, below roof surface.
- D. Piping Specialties.
 - 1. Install specialties in accordance with manufacturer's instructions.
 - 2. Mechanical type absorbers.
 - a. Comply with manufacturer's recommendations for size, location, and method of installation. Allow for servicing access.
 - b. Submit Shop Drawings showing details of installation and location for review.
- E. Wall hydrants: Neatly grout into place, hydrants installed in masonry or precast concrete walls.
- F. Floor Drains.
 - 1. Unless noted on Drawings, coordinate floor drain top elevations with Architect-Engineer prior to pouring concrete floor slabs.
 - 2. Set floor drains at proper elevations to attain satisfactory floor drainage.
 - 3. Set tops of floor drain strainers approximately 3/8 inch below level of finished floor, cast drains into concrete or terrazzo when floors are poured, and make watertight.
 - 4. Maintain drain's position during pour.
 - 5. Locate floor drains where they receive sufficient water to maintain seals in traps.
 - 6. Upon demand of plumbing inspector, install water connection for renewing trap seals.
- G. Cleanouts.
 - 1. Install cleanouts where indicated and as required by applicable codes.
 - 2. Aesthetically locate cleanouts with respect to tile patterns, masonry bond, and alignment. Coordinate installation with concrete and masonry work.
 - 3. Install cleanouts at ends of main and branch runs, at traps, in horizontal drainage lines changing direction 45 degrees or more, and at or near base of each vertical waste, soil stack, or conductor.

4. Where stack cleanouts are installed within walls, extend cleanout to back of wall and conceal with removable wall cover.
5. In straight trunk line sewers, sized 6 inches and smaller having no change in direction, install cleanouts on 50 foot centers maximum.
6. Install manholes for pipe sized 8 inches and larger at minimum 400 feet intervals and at every change in direction, grade elevation, and size.
7. Take below grade cleanout connections off top of drainage lines at angle of 45 degrees to pipe axis.
8. Install cleanouts in accessible locations and with minimum of 18 inches clearance.
9. Remove each threaded plug from cleanout assembly and make free turning.
10. Prior to acceptance of system, demonstrate that cleanout plugs are easily removable and that cleanouts can be easily rodded with standard rodding tools, if requested by Architect-Engineer.

3.02 FIELD QUALITY CONTROL

- A. Plumbing Systems Testing.
 1. In accordance with applicable general testing requirements specified in Section 22 0600 and as specified in this Section.
 2. Test pressure systems at 1-1/2 times systems operating pressure, or at test pressures indicated below, whichever is greater.
 3. Use hydro pressure test at 1-1/2 times system operating pressure or 150 psig whichever is greater for not less than 2 hours.
 - a. Allowable Pressure loss.
 - 1) Potable Water: Not more than 0 psig.
- B. Drainage, Waste, and Vent Piping Testing.
 1. Test piping hydrostatically at static head of 10 feet. No leakage is acceptable.
 2. Air tests may be substituted for hydrostatic tests by forcing air into closed system at uniform pressure sufficient to equalize column of mercury 10 inches in height or pressure of 5 psi.
 3. Test aboveground piping by closing openings in piping system, except highest opening above roof, and by filling to point of overflowing.
 4. Test pressure shall remain constant, after stabilization, for not less than 15 minutes without further addition of water or air.
 5. Maintain test pressure in aboveground systems for 1 hour.
 6. Maintain test pressure in underground systems for 1 hour.
- C. Testing of Backflow Prevention Devices.
 1. Performed by certified tester.
 2. Assure performance within limits of local Department of Public Health cross connection rules
- D. Plumbing Systems Flushing.
 1. Flush in accordance with applicable general flushing requirements specified in Section 22 0600 and as specified in this Section.
 2. Flush potable and nonpotable water systems after successful hydrostatic and leak tests, and cleaning operations.
 3. Prior to testing, thoroughly flush piping with water for period of 15 minutes or longer, to ensure removal of dirt, scale, oil, cuttings, and other foreign matter from piping system.
- E. Potable Water Systems Disinfection.
 1. Disinfecting of complete water systems shall be in accordance with AWWA C651, and in accordance with requirements of state or local authorities.
 - a. Consult with Owner's representative to determine preferred method for disinfection, if any.
 2. Disinfection process shall be done only by company specializing in water treatment, having experienced operators, and appropriate equipment.
 3. Conduct work under supervision of governing local or state authorities.

4. Disinfect completed potable water supply lines and distribution systems, with chlorine, before being placed in operation.
5. Chlorine dosage: Not be less than 50 parts per million.
6. Flush chlorinated water from system, following contact period, with clear water until residual chlorine content is not greater than 0.2 part per million.
7. Open and close valves in disinfected water lines at least 4 times during sterilization period.

END OF SECTION

SECTION 22 1020
SPECIAL PLUMBING SYSTEMS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. NFPA 54 - National Fuel Gas Code; 2009.

1.02 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. Product data.
 - 2. Test data.

1.03 WARRANTY

- A. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

1.04 QUALITY ASSURANCE

- A. Quality control provisions of Division 01, General Requirements, apply to this Section.
- B. Obtain reviews and acceptance, except as required for field installation, field applications, and field tests, before delivery of items of material, equipment, or systems to project site.
- C. Certificates of Conformance.
 - 1. Before delivery of equipment and materials specified in this Section, certificates of conformance or compliance, or certified test reports, attesting that equipment and materials listed meet specified requirements, shall be accepted, in triplicate, by Architect-Engineer.

PART 2 PRODUCTS

2.01 SYSTEMS

- A. Drawings indicate material and equipment locations, related piping layouts, and general design of systems listed below.
- B. Compressed Air.
 - 1. Pipe.
 - a. Type BS-2, black steel pipe.
 - 2. Joints.
 - a. Screwed for piping sized 2 inches and smaller.
 - b. Butt welded for piping sized 2-1/2 inches and larger, except at flanged equipment connections.
 - c. Use Type GASK1 gasketing and Type BOLT1 bolting for flanged joints.
 - d. Groove type fittings and couplings may be used for piping sized 3 inches and larger.
 - 3. General service valves.
 - a. Type GSV-1, refer to Section 22 0523.
- C. Natural Gas.
 - 1. Aboveground pipe.
 - a. Type BS-2, black steel pipe.
 - 2. Underground pipe.
 - a. Type BS-2, black steel pipe, corrosion protected as specified in Section 22 0600.
 - 3. Aboveground joints.
 - a. Socket welded for piping sized 2 inches and smaller.
 - b. Screwed joints may be used for systems or system portions less than 5 psig.
 - c. Butt welded for piping sized 2-1/2 inches and larger, except at flanged equipment connections.
 - d. Use Type GASK1 gasketing and Type BOLT1 bolting for flanged joints.
 - 4. Underground joints.

- a. Socket welded for piping sized 2 inches and smaller.
 - b. Butt welded for piping sized 2-1/2 inches and larger, except at flanged equipment connections.
 - c. Use Type GASK1 gasketing and Type BOLT1 bolting for flanged joints.
- 5. Valves.
 - a. Ball valves.

2.02 MANUFACTURED UNITS

- A. Compressed Air Traps.
 - 1. Automatic atomizing type with cast iron body and cover, stainless steel seat and internal parts, and nylon muffler.
 - a. Acceptable product.
 - 1) Nicholson, Drain-Air.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.
- B. Quick Disconnect Couplings.
 - 1. General purpose industrial interchange couplings meeting ISO 7241 Interchange and Performance Standards.
 - 2. Double shutoff poppet type with body, sleeve, valves, springs, and detent balls constructed of stainless steel, and with Buna-N O-ring seals.
 - 3. Acceptable products.
 - a. Aeroquip, FD-45 Series.
 - b. Hansen, HK Series.
 - c. Parker, 60 Series.
 - d. Safeway, S-10 Series.
 - e. Snap-Tite, 72 Series.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
- C. Compressed Air Regulators.
 - 1. 1/2 inch combination filter-regulator, with reduced pressure range of 5 to 20 psig, where indicated on Drawings, and for instruments and controls requiring control air.
 - 2. Acceptable product.
 - a. Fisher Controls, Type 67FR.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. Compressed Air Regulator-Filter-Lubricator Assembly.
 - 1. Filter, pressure regulating valve, and automatic lubricator arranged in series.
 - 2. Rated for working pressure of 150 psig.
 - 3. Filters.
 - a. Cartridge type.
 - b. Filtering element capable of filtering particles sized 50 microns maximum and having metal guard enclosed housing with automatic drain.
 - 4. Pressure regulator.
 - a. Adjustable from 3 psig to 100 psig.
 - b. Include pressure gauge.
 - 5. Lubricators.
 - a. Oil fog type with.
 - 1) 1 quart reservoir.
 - 2) Drain valve.
 - 3) Oil level sight gauge.
 - 4) Metal guards.
 - 6. Acceptable products.
 - a. C.A. Norgren, Lubro Control Units.
 - b. Watts.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- E. Gas Pressure Regulating Valves.

1. Tight shutoff, self-contained, pilot loading, pressure equalizing, diaphragm operated regulators, designed for gas service and including suitable safety relief valve.
2. Rate valve for capacity, pressure rating, and setpoint indicated on drawings.
3. Acceptable manufacturers.
 - a. Fisher Controls.
 - b. Maxon.
 - c. Invensys Energy Metering (Equimeter).
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 EQUIPMENT

2.04 MATERIALS

- A. Pipe Schedules, Valves, and Accessories.
 1. For special systems specified, refer to Section 22 0600 for pipe schedules, general service valves, and related accessory requirements.
 2. Include pipe materials, valves, and fittings for natural gas systems in accordance with NFPA 54, unless otherwise specified.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General Installation Requirements.
 1. Install, test, and clean piping in accordance with requirements specified in Section 22 0600 and as specified in this Section.
 2. Gas pipe installation in accordance with NFPA.
 3. Install natural gas systems as specified in Section 22 0600 and in accordance with NFPA 54, unless otherwise specified.
- B. Compressed Air Trap Installation.
 1. Install at low points of system and as indicated on drawings.
 2. Include Y-type strainer on inlet side, and extend piping from discharge to nearest drainage inlet.
- C. Gas Pressure Regulator Valve Installation.
 1. Install in accordance with NFPA 54 for natural gas systems.
 2. Run vent to outside of building.
- D. Pressure Pipe Testing.
 1. Comply with applicable general testing requirements specified in Section 22 0600, and as specified in this Section.
 2. Acceptable pressure loss (psig): None on pneumatic pressure test for 2 hours at 1-1/2 times system operating pressure or at test pressures indicated below, whichever is greater.
 - a. Compressed air: 150 psig.
 - b. Natural gas: 150 psig.
- E. Flushing and Purging Systems.
 1. In accordance with general requirements specified in Section 22 0600, and requirements specified in this Section.
 2. Unless otherwise specified, purge compressed air or gas systems by blowing out pipe with compressed air through dirt pockets and open ends of piping until air shows no evidence of contamination.
 3. Flush and purge natural gas piping in accordance with requirements of NFPA 54 and local gas company.
 4. Where connecting to existing piping, purge existing piping adjacent to point of connection, up to and including nearest shutoff valve.
 5. Do not discharge piping systems being purged, into confined spaces unless adequate ventilation exists.

6. Check entire system before gas is admitted to added and extended systems, to ensure no open ends or fittings, and that valves at outlets and equipment are closed.

END OF SECTION

SECTION 22 1113
FACILITY WATER DISTRIBUTION PIPING

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 water-distribution piping and related components outside the building for water service.

1.3 DEFINITIONS

- A. EPDM: Ethylene propylene diene terpolymer rubber.
- B. LLDPE: Linear, low-density polyethylene plastic.
- C. PA: Polyamide (nylon) plastic.
- D. PE: Polyethylene plastic.
- E. PP: Polypropylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
- H. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends and flange faces.
 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
1. Notify Owner no fewer than two days in advance of proposed interruption of service.
 2. Do not proceed with interruption of water-distribution service without Owner's written permission.

1.8 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Gaskets: AWWA C111, rubber.
- C. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
1. Grooved-End, Ductile-Iron Pipe Appurtenances:
 - a. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
 - b. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- D. Flanges: ASME 16.1, Class 125, cast iron.

2.2 JOINING MATERIALS

- A. Brazing Filler Metals: AWS A5.8, BCuP Series.
- B. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

- C. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.3 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:
 - 1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
 - a. Standard: AWWA C219.
 - b. Center-Sleeve Material: Manufacturer's standard .
 - c. Gasket Material: Natural or synthetic rubber.
 - d. Pressure Rating: 150 psig minimum.
 - e. Metal Component Finish: Corrosion-resistant coating or material.
- C. Split-Sleeve Pipe Couplings:
 - 1. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
 - a. Standard: AWWA C219.
 - b. Sleeve Material: Manufacturer's standard.
 - c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
 - d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
 - e. Pressure Rating: 150 psig minimum.
 - f. Metal Component Finish: Corrosion-resistant coating or material.
- D. Flexible Connectors:
 - 1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
 - 2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

2.4 GATE VALVES

- A. AWWA, Cast-Iron Gate Valves:
 - 1. Nonrising-Stem, Resilient-Seated Gate Valves:
 - a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 200 psig.
 - 3) End Connections: Mechanical joint.
 - 4) Interior Coating: Complying with AWWA C550.
- B. UL/FMG, Cast-Iron Gate Valves:
 - 1. UL/FMG, Nonrising-Stem Gate Valves:
 - a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
 - 1) Standards: UL 262 and FMG approved.
 - 2) Minimum Pressure Rating: 175 psig.
 - 3) End Connections: Flanged.
 - 2. OS&Y, Rising-Stem Gate Valves:
 - a. Description: Iron body and bonnet and bronze seating material.
 - 1) Standards: UL 262 and FMG approved.
 - 2) Minimum Pressure Rating: 175 psig.
 - 3) End Connections: Flanged.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

- A. Tapping-Sleeve Assemblies:

1. Description: Sleeve and valve compatible with drilling machine.
 - a. Standard: MSS SP-60.
 - b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
 - c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.
- B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
 1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.6 CHECK VALVES

- A. AWWA Check Valves:
 1. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
 - a. Standard: AWWA C508.
 - b. Pressure Rating: 175 psig.
- B. UL/FMG, Check Valves:
 1. Description: Swing-check type with pressure rating; rubber-face checks, unless otherwise indicated; and ends matching piping.
 - a. Standards: UL 312 and FMG approved.
 - b. Pressure Rating: 175 psig.

2.7 DETECTOR CHECK VALVES

- A. Detector Check Valves:
 1. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
 - a. Standards: UL 312 and FMG approved.
 - b. Pressure Rating: 175 psig.
 - c. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

2.8 WATER METERS

- A. Water meters will be furnished by utility company.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.

- D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping NPS 4 to NPS 8 shall be the following:
 - 1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.
- F. Underground Fire-Service-Main Piping NPS 4 to NPS 12 shall be the following:
 - 1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.
- G. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 12 shall be the following:
 - 1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.

3.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient - seated gate valves with valve box.
 - 2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
 - 3. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
 - 4. Relief Valves: Use for water-service piping in vaults and aboveground.
 - a. Air-Release Valves: To release accumulated air.
 - b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
 - c. Combination Air Valves: To release or admit air.
 - 5. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. See Division 2 Section "Piped Utilities - Basic Materials and Methods" for piping-system common requirements.

3.5 PIPING INSTALLATION

- A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
- B. Make connections larger than NPS 2 with tapping machine according to the following:
 - 1. Install tapping sleeve and tapping valve according to MSS SP-60.
 - 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
 - 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
 - 4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- C. Make connections NPS 2 and smaller with drilling machine according to the following:
 - 1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
 - 2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
 - 3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
 - 4. Install corporation valves into service-saddle assemblies.
 - 5. Install manifold for multiple taps in water main.
 - 6. Install curb valve in water-service piping with head pointing up and with service box.

- D. Comply with NFPA 24 for fire-service-main piping materials and installation.
- E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- F. Bury piping with depth of cover over top at least 36 inches , with top at least 12 inches below level of maximum frost penetration, and according to the following:
 - 1. Under Driveways: With at least 36 inches cover over top.
 - 2. In Loose Gravelly Soil and Rock: With at least 12 inches additional cover.
- G. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- H. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 - 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- I. Mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- J. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- K. See Division 13 Section "Fire-Suppression Piping" for fire-suppression-water piping inside the building.
- L. See Division 15 Section "Domestic Water Piping" for potable-water piping inside the building.

3.6 JOINT CONSTRUCTION

- A. See Division 2 Section "Piped Utilities - Basic Materials and Methods" for basic piping joint construction.
- B. Make pipe joints according to the following:
 - 1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
 - 2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

3.7 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - 1. Concrete thrust blocks.
 - 2. Locking mechanical joints.
 - 3. Set-screw mechanical retainer glands.
 - 4. Bolted flanged joints.
 - 5. Heat-fused joints.
 - 6. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 - 2. Fire-Service-Main Piping: According to NFPA 24.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

- D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.
- E. MSS Valves: Install as component of connected piping system.
- F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.
- G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.
- H. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.9 DETECTOR-CHECK VALVE INSTALLATION

- A. Install in vault or aboveground.
- B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.
- C. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.10 CONNECTIONS

- A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. See Division 2 Section "Piped Utilities - Basic Materials and Methods" for piping connections to valves and equipment.
- C. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.
- D. Connect water-distribution piping to interior fire-suppression piping.
- E. Ground equipment according to Division 16 Section "Grounding and Bonding."
- F. Connect wiring according to Division 16 Section "Conductors and Cables."

3.11 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
 - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- C. Prepare reports of testing activities.

3.12 IDENTIFICATION

- A. Install continuous underground warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 2 Section "Earthwork."

3.13 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.

- c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION

SECTION 22 1313
FACILITY SANITARY SEWERS

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. Pipe and fittings.
 - 2. Nonpressure and pressure couplings.
 - 3. Expansion joints and deflection fittings.
 - 4. Backwater valves.
 - 5. Cleanouts.
 - 6. Encasement for piping.
 - 7. Manholes.

1.3 DEFINITIONS

- A. FRP: Fiberglass-reinforced plastic.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Expansion joints and deflection fittings.
 - 2. Backwater valves.
- B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

- A. Pipe: ASTM A 746, for push-on joints.
- B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.
- C. Compact Fittings: AWWA C153, ductile iron, for push-on joints.
- D. Gaskets: AWWA C111, rubber.

2.2 PVC PIPE AND FITTINGS

- A. PVC Cellular-Core Sewer Piping:
 - 1. Pipe: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
 - 2. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.
- B. PVC Corrugated Sewer Piping:
 - 1. Pipe: ASTM F 949, PVC corrugated pipe with bell-and-spigot ends for gasketed joints.

2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
 3. Gaskets: ASTM F 477, elastomeric seals.
- C. PVC Profile Sewer Piping:
1. Pipe: ASTM F 794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
 2. Fittings: ASTM D 3034, PVC with bell ends.
 3. Gaskets: ASTM F 477, elastomeric seals.
- D. PVC Type PSM Sewer Piping:
1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
 2. Fittings: ASTM D 3034, PVC with bell ends.
 3. Gaskets: ASTM F 477, elastomeric seals.
- E. PVC Gravity Sewer Piping:
1. Pipe and Fittings: ASTM F 679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.3 NONPRESSURE-TYPE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings:
1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Shielded, Flexible Couplings:
1. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- E. Ring-Type, Flexible Couplings:
1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
- F. Nonpressure-Type, Rigid Couplings:
1. Description: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling, molded from ASTM C 1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.4 BACKWATER VALVES

- A. Cast-Iron Backwater Valves:
1. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
 2. Horizontal type; with swing check valve and hub-and-spigot ends.
 3. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
 4. Terminal type; with bronze seat, swing check valve, and hub inlet.
- B. PVC Backwater Valves:
1. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.5 CLEANOUTS

- A. Cast-Iron Cleanouts:

1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
- B. PVC Cleanouts:
 1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.6 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105.
- B. Material: Linear low-density polyethylene film of 0.008-inch (0.20-mm) or high-density, cross-laminated polyethylene film of 0.004-inch (0.10-mm) minimum thickness.
- C. Form: Sheet or tube.
- D. Color: Black or natural.

2.7 MANHOLES

- A. Standard Precast Concrete Manholes:
 1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 2. Diameter: 48 inches minimum unless otherwise indicated.
 3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
 5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
 6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
 7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 9. Steps: Individual FRP steps or FRP ladder; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 48.
 10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.
- B. Manhole Frames and Covers:
 1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch- minimum-width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
 2. Material: ASTM A 536, Grade 60-40-18 ductile or ASTM A 48/A 48M, Class 35 gray iron unless otherwise indicated.
- C. Manhole-Cover Inserts:
 1. Description; Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.

2.8 CONCRETE

- A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:
 1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.

- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
 - 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: 1 percent through manhole.
 - 2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 4 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 31 2000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at the indicated slope.
 - 2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
 - 3. Install piping with 48-inch minimum cover; less than 48-inch requires engineer approval.
 - 4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 - 5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
 - 6. Install ductile-iron, gravity sewer piping according to ASTM A 746.
 - 7. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 8. Install PVC cellular-core sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 9. Install PVC corrugated sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 10. Install PVC profile sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 11. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 12. Install PVC gravity sewer piping according to ASTM D 2321 and ASTM F 1668.

13. Install fiberglass sewer piping according to ASTM D 3839 and ASTM F 1668.
 14. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
 15. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
- G. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure, drainage piping according to the following:
1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
 2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
 3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
 4. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
 5. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.
 6. Join PVC cellular-core sewer piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
 7. Join PVC corrugated sewer piping according to ASTM D 2321.
 8. Join PVC profile sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
 9. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
 10. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
 11. Join fiberglass sewer piping according to ASTM D 4161 for elastomeric-seal joints.
 12. Join nonreinforced-concrete sewer piping according to ASTM C 14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
 13. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
 14. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.
- B. Join force-main, pressure piping according to the following:
1. Join ductile-iron pressure piping according to AWWA C600 or AWWA M41 for push-on joints.
 2. Join ductile-iron special fittings according to AWWA C600 or AWWA M41 for push-on joints.
 3. Join PVC pressure piping according to AWWA M23 for gasketed joints.
 4. Join PVC water-service piping according to ASTM D 2855.
 5. Join dissimilar pipe materials with pressure-type couplings.
- C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. Unshielded, flexible or rigid couplings for pipes of same or slightly different OD.
 - b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
 2. Use pressure pipe couplings for force-main joints.

3.4 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Install FRP manholes according to manufacturer's written instructions.
- D. Form continuous concrete channels and benches between inlets and outlet.
- E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.
- F. Install manhole-cover inserts in frame and immediately below cover.

3.5 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.6 BACKWATER VALVE INSTALLATION

- A. Install horizontal-type backwater valves in piping manholes or pits.
- B. Install combination horizontal and manual gate valves in piping and in manholes.
- C. Install terminal-type backwater valves on end of piping and in manholes. Secure units to side-walls.

3.7 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
 - 2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
 - 3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
 - 4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.8 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."
- B. Connect force-main piping to building's sanitary force mains specified in Section 221316 "Sanitary Waste and Vent Piping." Terminate piping where indicated.
- C. Make connections to existing piping and underground manholes.
 - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 - 2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 - 3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

- b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
- 4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.9 CLOSING ABANDONED SANITARY SEWER SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 - 1. Close open ends of piping with at least 8-inch- thick, brick masonry bulkheads.
 - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:
 - 1. Remove manhole and close open ends of remaining piping.
 - 2. Remove top of manhole down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.
- C. Backfill to grade according to Section 312000 "Earth Moving."

3.10 IDENTIFICATION

- A. Comply with requirements in Section 312000 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
 - 1. Use warning tape or detectable warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.11 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate report for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.
 - 5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
 - b. Close openings in system and fill with water.
 - c. Purge air and refill with water.
 - d. Disconnect water supply.

- e. Test and inspect joints for leaks.
- 6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
 - b. Option: Test concrete gravity sewer piping according to ASTM C 924.
- 7. Manholes: Perform hydraulic test according to ASTM C 969.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

- A. Clean dirt and superfluous material from interior of piping.

END OF SECTION

SECTION 22 3000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 22 0600 - Basic Plumbing Materials and Methods.
- B. Section 22 0700 - Plumbing Insulation.
- C. Section 22 1010 - Plumbing Systems and Specialties.
- D. Section 22 1123 - Domestic Water Pumps.

1.02 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. Product data.
- C. For Closeout.
 - 1. Operation and maintenance data.

1.03 QUALITY ASSURANCE

- A. Quality control provisions of Division 01, General Requirements, apply to this Section.
- B. Reviews and acceptance, except as required for field installation, field applications, and field tests, shall be obtained before delivery of items of material, equipment, or systems to project site.
- C. Plumbing equipment work shall be in accordance with ASME Boiler and Pressure Vessel Code.

1.04 WARRANTY

- A. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

1.05 MANUFACTURER'S GUARANTEE

PART 2 PRODUCTS

2.01 EQUIPMENT

- A. WATER COOLERS AND DRINKING FOUNTAINS
 - 1. Bi-level, wall mount, High-efficiency electric, refrigerated water cooler and bottle filling station with attached drinking fountain.
 - a. Unit shall be lead free design which meets Safe Drinking Water Act and is certified to NSF/ANSI 61 and ADA Compliant for frontal or parallel approach.
 - b. Unit shall have stainless steel basin with integral basin.
 - c. Galvanized structural steel cooler chassis provide structural integrity.
 - d. Cooler unit shall have push-bar activation and water-efficient bubbler. Cooler unit shall include filter, certified to NSF/ANSI 42 and 53 for lead reduction, with visual monitor to indicate when replacement is necessary.
 - e. Cooling system.
 - 1) High efficiency compressor, hermetically-sealed, reciprocating type, single phase. Sealed-in lifetime lubrication.
 - 2) Compressor: Fan cooled, copper tube with aluminum fins.
 - 3) Temperature control: Easily accessible enclosed adjustable thermostat to control water temperature.
 - f. Unit shall provide 8.0 gph of 50 degrees F water at 90 degrees F ambient and 80 degrees F inlet water.
 - g. Bottle filler shall provide 1.1 gpm flow rate with laminar flow to minimize splashing.
 - h. Bottle filling unit shall include an electronic sensor for no-touch activation with an automatic 20-second shut-off timer.
 - i. Unit shall include antimicrobial protected plastic components to prevent mold and mildew.

- j. Unit shall include Green ticker displaying count of plastic bottles saved from waste.
 - k. Unit shall be certified to UL399 and Green-Spec listed.
 - l. Miscellaneous construction: Easy touch front and side push bar controls. Integrated Silver Ion Anti-microbial Protection. Drain System eliminates standing water. Filter Monitor indicates when replacement is necessary. Flexi-Guard Stream-Saver Safety Bubbler utilizes an anti-microbial pliable polyester elastomer to prevent accidental mouth injuries.
 - m. Electrical characteristics.
 - 1) Operates on 115 Volt AC, 60 hertz, single phase.
 - n. Acceptable product:
 - 1) Elkay, Model LZSTLG8WSD.
- B. Type EWH-A, Electric Water Heater.
- 1. Vertical, short, nonindustrial type with glass lined, copper bearing, insulated tank, having enameled steel casing, low watt density heating element, magnesium anode tank protection, double break, snap action thermostat, high limit temperature cutout, and standard electrical outlet box.
 - 2. Acceptable products.
 - a. Bradford White, Electric-Lowboy.
 - b. Lochinvar, Junior.
 - c. A.O. Smith, ELJF.
 - d. State Water Heaters, Courier V Midget Electric.
- C. Garbage Disposal.
- 1. Continuous feed type, having.
 - a. Stainless steel impellers, grind ring, and turntable.
 - b. Corrosionproof housing with sound insulation.
 - c. Quick mount installation.
 - 2. Motor.
 - a. 1/2 hp, 2700 rpm.
 - b. 110 volt, 60 hertz, single phase.
 - 3. Acceptable manufacturers.
 - a. General Electric.
 - b. In-Sink-Erator.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

PART 3 EXECUTION

3.01 INSTALLATION

- A. Equipment, General.
 - 1. Connect supply and drainage trim for plumbing equipment to rough piping systems at wall, unless otherwise indicated.
 - 2. Furnish and install chrome plated or nickel plated brass, exposed-to-view trim, including building surface penetration and support escutcheons and fasteners.
 - 3. Install equipment in accordance with manufacturer's published instructions and as specified.

END OF SECTION

SECTION 22 4000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. Certificates.
 - a. Free from traces of silicone.
- C. Silicones.
 - 1. Materials and equipment for this Project: Silicone-free.
 - 2. Factory installed or field applied lubricants, sealants, coatings, and gasketing, containing silicones are prohibited.
 - 3. Submit written certification that materials and equipment installed or consumed in construction are free from traces of silicone.

1.02 QUALITY ASSURANCE

- A. Quality control provisions of Division 01, General Requirements, apply to this Section.
- B. Reviews and acceptance, except approvals required for field installation, field applications, and field tests, shall be obtained before delivery of items of material, equipment, or systems to project site.
- C. Certificates of Conformance - Before delivery of fixtures and trim, certificates of conformance or compliance and certified test reports, in triplicate, attesting that equipment and materials meet requirements specified, shall be accepted by Architect-Engineer.

1.03 WARRANTY

- A. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Plumbing Fixtures, General.
 - 1. Furnish fixtures complete with supply, waste, soil, and vent piping connections, fittings, traps, supports, fastening devices, valves, and accessories required for complete and serviceable installation.
 - 2. For lavatory and sink supply assemblies, furnish chrome plated 3/8 inch brass supplies, loose key angle valves, escutcheons where connected to wall supplies, and chrome plated flexible copper tube risers.
 - 3. Earthenware: Unmarked, true, and level.
 - 4. Warrant vitreousware not to craze, discolor, or scale.
 - 5. Furnish white plumbing fixtures, unless otherwise specified.
 - 6. Furnish polished chrome plated traps, connections, fittings, valves, drain tubing, trim, and escutcheons where exposed, located under countertops, or installed within cabinetry.
 - 7. Refer to appropriate articles in this Section for trim requirements specified with fixtures.
 - 8. Furnish faucets and shower heads with nonadjustable, approximately 2-1/2 gallons per minute, flow control devices.
 - 9. Furnish extended length handles on single handle mixing valves in lavatories designated barrier-free.
 - 10. Furnish ADA compliant sinks and lavatories with proper bowl depths, drain locations, faucets, and protection for exposed pipes and surfaces meeting ADA standards.
 - 11. Except in areas for use by public or where otherwise indicated, furnish faucets and spouts without aerators.
- B. Fixture Supports.

1. Support wall hung fixtures with factory made carriers and supports selected for the particular installation conditions.
 2. Support lavatories with concealed adjustable arm carriers with steel pipe uprights, bolted base feet, and chrome plated support arm escutcheons as required for correct support.
 3. Support water closets on carriers with adjustable fittings, drain connections, and bolted base feet.
 4. Support urinals on carriers with mounting plates, steel pipe uprights, and bolted base feet.
 5. Support wall hung sinks using carriers having steel pipe uprights and bolted base feet.
 6. Acceptable manufacturers.
 - a. Josam.
 - b. J.R. Smith.
 - c. Mifab.
 - d. Wade.
 - e. Watts.
 - f. Zurn.
 - g. Substitutions: See Section 01 6000 - Product Requirements.
- C. Type WC-A Water Closet: Wall hung, vitreous china, water saving, siphon jet type with elongated rim and 1-1/2 inch top spud.
1. Acceptable products.
 - a. American Standard, AFWall 2257.103.
 - b. Eljer, Auburn 111-1505.
 - c. Kohler, Kingston K-4330.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
 2. Flush valve: Type WCFV-1.
 3. Seat: Type WCS-1, or Type WCS-2 where barrier-free water closet is indicated.
- D. Type UR-A, Urinal: Wall hung, vitreous china, washout type, 18 inches wide, with extended shields, flush spreader, 3/4 inch top spud, integral trap, and 2 inch back outlet connection.
1. Acceptable products.
 - a. American Standard, Washbrook 6501.010.
 - b. Crane, Cromwell 7-187.
 - c. Eljer, Correcto 161-1030.
 - d. Kohler, Bardon K-4960-T.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
 2. Flush valve: Type URFV-1.
- E. Type LAV-A, Lavatory: Flat slab top, vitreous china, wall hung type, 20 inches by 18 inches, with front overflow, cast-in soap depression, 8 inch center faucet holes, and cored for concealed arm supports.
1. Acceptable products.
 - a. American Standard, Roxalyn 0194.076.
 - b. Eljer, Mayburne 051-2548.
 - c. Crane, Norwich 1-165-S.
 - d. Kohler, Jamestown K-2053.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
 2. Lavatory trim: Type LF-1 lavatory faucet, and Type T-1 trap.
- F. Service Sink, Type SS-B: Terrazzo service receptor, 24 inches by 24 inches by 12 inches, chrome plated brass drain cast integral with basin, removable chrome plated brass strainer, and stainless steel caps on sides not contacting walls.
1. Acceptable products.
 - a. Fiat, TSB-100.
 - b. Stern-Williams, Serviceptor SB-902.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
 2. Sink trim: Type SF-6 faucet.

- G. Type STS, Stainless Steel Sinks: Countertop, lay-in, self-rimming, seamless, 18 gauge, polished, Type 304 stainless steel sinks with sound dampened underside, sized as indicated on Drawings, and punched to receive supply trim and 3-1/2 inch strainer.
 - 1. Refer to sink schedule for size and supply trim required.
 - 2. Acceptable products.
 - a. Elkay, Lustertone.
 - b. Just, Group A.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
 - 3. Sink trim.
- H. Lavatory and sink faucets, spouts, or mixing valves.
 - 1. Type LF-1 lavatory faucet: Combination dual handle faucet and pop-up drain with 8 inch centers, renewable seats, chrome plated handles, aerator, and 1-1/4 inch chrome plated tailpiece.
 - a. Acceptable products.
 - 1) American Standard, 6502.140.
 - 2) Cambridge Brass, 23T441.
 - 3) Chicago Faucet, No. 1746A.
 - 4) Crane, C-1116.
 - 5) Delta, 3501WFLGHDF with RP6346.
 - 6) Kohler, Triton K-7437-2E.
 - 7) T & S Brass, No. B2881/180F.
 - 8) Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Type SF-6 sink faucet: Wall-mounted, polished chrome-plated, dual handle faucet with vacuum breaker, suitable for 8 inch centers, and having 3/4 inch hose thread on spout, wall top brace, pail hook, and integral stops.
 - a. Acceptable products.
 - 1) American Standard, 8344.112.
 - 2) Chicago Faucet, 897.
 - 3) Fiat, 830AA.
 - 4) Speakman, Commander SC-5811.
 - 5) T & S Brass, No. B667PC.
 - 6) Substitutions: See Section 01 6000 - Product Requirements.
- I. Lavatory or Sink Drains.
 - 1. Type D-1 lavatory drain: Chrome-plated perforated grid drain with 1-1/4 inch tailpiece.
 - a. Acceptable products.
 - 1) American Standard, 2411.015.
 - 2) Cambridge Brass, 33T260.
 - 3) Crane, CH-8581.
 - 4) Delta, RP6346.
 - 5) Kohler, K-7715.
 - 6) T & S Brass, No. B-899.
 - 7) Substitutions: See Section 01 6000 - Product Requirements.
- J. Traps.
 - 1. Type T-1 trap: Adjustable, semicast brass P-trap with 1-1/4 inch inlet and outlet, cleanout plug, waste tubing to wall, and wall flange, with chrome-plated components.
- K. Miscellaneous Lavatory Trim.
 - 1. Barrier-free insulation kit: Molded, closed cell vinyl system or PVC system covering trap, angle valve, and supply tube assemblies.
 - 2. Furnish in manufacturer's standard color and complete with nylon or velcro fastener system
 - 3. Acceptable products.
 - a. Truebro, Handi Lav-Guard Insulation Kit.
 - b. Plumberex, Handy-Shield Pro-2000 Series.

- c. Brocar Products, Trap Wrap.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- L. Sensor Operated Flush Valves.
 - 1. General.
 - a. ASME A112.18.1; exposed chrome plated, diaphragm type with low voltage operated solenoid operator, infrared sensor and over-ride button in chrome plated plate, wheel handle stop and vacuum breaker; maximum 1.6 gallon flush volume.
 - b. 120 volt to 24 volt transformer, hardwired to 120 volt service with fuse block and 24 volt wiring to sensor and solenoid valve.
 - c. 1 transformer able to serve up to 10 water closets or 10 urinals, or combination of both equaling 10.
 - d. Include 4 inch by 4 inch electrical enclosure box.
 - 2. Type WCAFV-1 water closet automatic flush valve: Short, water saving type with 1-1/2 inch top spud coupling.
 - a. Acceptable products.
 - 1) Sloan Valve Company; Royal 111 ES-S.
 - 2) Zurn Industries, Inc; AquaVantage ZEMS6000AV.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
 - 3. Type URFV-1 urinal flush valve: 3/4 inch top spud coupling.
 - a. Acceptable products.
 - 1) Sloan, Royal/Regal 186 ES-S.
 - 2) Zurn, Aquaflush ZEMS-IS6003AV-WS1.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
- M. Water Closet Seats.
 - 1. Type WCS-1: Open front, solid plastic seat, white in office and hospital areas and black in factory areas, with check hinges and no cover.
 - a. Acceptable products.
 - 1) Olsonite, 10-CC/SS.
 - 2) Sanderson Plumbing Products, Beneke 523 SS.
 - 3) Centoco, 500 CC/SS.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Fixtures.
 - 1. Install in accordance with manufacturer's instructions.
 - 2. Connect supply and drainage trim for fixtures to roughed-in piping systems.
 - 3. Conceal lavatory support arms with escutcheons furnished with fixture.
 - 4. Install lavatories designated barrier-free in accordance with ADA regulations.
 - 5. Install barrier free insulation kit on exposed traps and supplies of barrier-free lavatories.
 - 6. Securely bolt and anchor supports to supporting surface.
 - 7. Install wall hung fixtures snugly against wall and seal each fixture setting with plastic sealer to produce tight fit.
 - 8. Install flush valves with actuator on accessible side, in accordance with ADA regulations.
 - 9. Separately trap fixtures not having integral traps. Place water seal trap as close as possible to fixture outlet. A fixture shall not be double trapped. Traps shall be self-scouring type.
 - 10. Sinks for barrier-free ADA applications shall have bowls with a maximum depth of 6-1/2 inches and ADA compliant sinks and lavatories shall be mounted with counter or rim no higher than 34 inches above finish floor and at least 27 inches of knee clearance from underside of bowl to finish floor. Drain hole location shall be rear center to protect against contact.
- B. Food Service Equipment.

1. Food service equipment will be furnished and set in place under another contract.
 2. Refer to Sections 22 0600 and 22 1010 for piping rough-in requirements.
 3. Drawings show equipment locations and general piping arrangement and connections.
 4. Kitchen sinks.
 - a. Unless otherwise specified, install supply trim and overflow assemblies furnished with kitchen sinks.
 - b. Trim and overflow assemblies shall be separately boxed and tagged for each specific fixture.
- C. Laboratory Casework Accessories.
1. Laboratory casework, including bench sinks and miscellaneous equipment, shall be furnished, set, and installed under related headings.
 2. Hot and cold water faucets and tailpieces for sinks shall be furnished under related headings and installed under this Section complete with every necessary plumbing connection.
 3. Furnish and install appropriate traps, adapters, and necessary appurtenances and accessories.
- D. Fixture Connections.
1. Following are minimum sizes for connections to single plumbing fixtures.
- | Fixtures | Trap | Waste | Soil or Vent | Cold Water | Hot Water |
|--------------------------|--------------|--------------|--------------|--------------|-----------|
| Water closet tank type | ---- | 4 inches | 2 inches | 1/2 inch | ---- |
| Water closet flush valve | ---- | 4 inches | 2 inches | 1-1/4 inches | ---- |
| Urinals | ---- | 2 inches | 1-1/2 inches | 1 inch | ---- |
| Lavatory | 1-1/4 inches | 1-1/2 inches | 1-1/4 inches | 1/2 inch | 1/2 inch |
| Service sink | 3 inches | 3 inches | 1-1/2 inches | 3/4 inch | 3/4 inch |
| Shower | 3 inches | 3 inches | 1-1/2 inches | 1/2 inch | 1/2 inch |
| Washfountain | 2 inches | 2 inches | 1-1/2 inches | 3/4 inch | 3/4 inch |

END OF SECTION

SECTION 23 0000

MECHANICAL

PART 1 GENERAL

PART 2 PRODUCTS

2.01 AIR CONDITIONING

- A. The Auburn Facilities Building 8 is divided in two main areas, Office Area and Warehouse/Storage Area.
- B. Office Area will be conditioned by Split System Heat Pump Air Handling Unit. Electric reheat will be included in this unit to provide supplemental heating when needed.
- C. Manufacturer:
 - 1. Trane or approved equal. Refrigerant: R410a.
 - 2. Efficiency: 13 SEER.
- D. Warehouse/Storage Area will be provided with Heating and Ventilating only. Heating will be provided by gas fired radiant heaters. Ventilation will be by wall exhaust fans and wall louvers.
- E. Manufacturer:
 - 1. Detroit Radiant ReVerber-ray or approved equal.
- F. IT/Communications room will be conditioned by ductless split system cooling only with capability of cooling during low temperature times.
 - 1. Manufacturer: Mitsubishi or approved equal. Refrigerant: R410a.
 - 2. Efficiency: 13 SEER.
- G. Refrigerant tubing shall be copper tube ASTM B 280, Type CR.
- H. AC unit drain lines shall be ASTM B 88, Type L hard drawn copper tubing with soldered joints. Refrigerant pipe insulation for 1 inch and less shall be 1/2 inch thick foamed plastic pipe insulation equal to Armaflex, AP.
- I. AC unit drain line insulation shall be 1/2 inch thick foamed plastic pipe insulation equal to Armaflex, AP.
- J. HVAC equipment will be located on housekeeping pads. Air handling units will be of double wall construction and equipped with stainless steel drain pans.

2.02 BUILDING EXHAUST

- A. Toilets and janitor's closets shall be exhausted by individual ceiling-mounted exhaust fans equal to Greenheck SP. Exhaust ducts shall route to pitched roof cap equal to Greenheck RJ.
- B. Warehouse/Storage Area will be ventilated by wall exhaust fans and wall louvers.

2.03 DUCTWORK

- A. Ductwork shall be low pressure Class A construction and minimum of 26 gauge steel (any steel thinner than 26 gauge will not be accepted). Ducts shall be externally insulated. Duct wrap insulation shall be equal to Johns Manville; Microlite. Any exposed ductwork shall be round double-wall duct with insulation and perforated inner liner.

2.04 AIR DEVICES

- A. Diffusers/Registers or Grilles will be corrosion resistant aluminum construction.
- B. Supply air ceiling devices shall be equal to Titus TDC Return air ceiling devices shall be equal to Titus 50F.
- C. Sidewall supply air devices shall be equal to Titus 300F.
- D. Linear slot diffusers shall be equal to Titus TBDI-30.

2.05 CONTROLS

- A. Controls shall be Johnson Controls and shall tie-in to existing AU campus automation system.

PART 3 EXECUTION

END OF SECTION

SECTION 23 0548

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop drawings.
 - a. Equipment rails and bases.
 - b. Air mount system including.
 - 1) Air mount details.
 - 2) Leveling valves and linkage.
 - 3) Level control piping diagrams.
 - 4) Air pressure regulating valves.
 - 5) Control panel for modulating supply air pressure.
- C. For Information.
 - 1. Product data.
 - a. Vibration isolators indicating.
 - 1) Equipment requiring isolation.
 - 2) Spring outside diameters.
 - 3) Free, operating, and solid heights.
 - 2. Design data.
 - a. Weight of equipment.
 - b. Distribution of weight to support points.
 - c. Report of air mount pressure test.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Selection Criteria.
 - 1. Select vibration isolators for actual load imposed, and in accordance with Table, Selection Guide for Vibration Isolation, in Sound and Vibration Control chapter of ASHRAE HVACA.
 - 2. Scheduled or specified static deflection requirements relate to actual static deflection of individual mounts under their particular loads.
 - 3. Unacceptable vibration isolator mounts include.
 - a. Vibration isolator mounts selected on the basis of cataloged, nominal static, deflection, while ignoring decrease in isolation efficiency due to loadings to less than those of nominal rating.
 - b. Isolator mounts loaded in excess of their rated load capacity.
 - c. Isolators selected by equally dividing total weight of equipment by proposed number of isolators.
 - 1) Except where supported equipment is symmetrical about its vertical axis.
 - 4. Isolator springs shall have ratio of horizontal to vertical spring constants of not less than 0.8, be horizontally unrestrained, of diameter not less than 80 percent of height at rated load and allow reserve travel of 50 percent of rated deflection from height at rated load to shorted turns condition.
 - 5. Elastic limit of springs shall not be exceeded at shorted turns conditions.
 - 6. Equip isolator mounts having steel springs with means for leveling suspended equipment.
- B. Dip coat steel elements of outdoor isolators with weather resistant paint.
- C. Equipment Bases and Rails.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General.
 - 1. Install vibration isolation materials and equipment bases in accordance with manufacturer's written instructions.
 - 2. Level mountings so each mount carries assigned load.
 - a. Mounts showing evidence of insufficient or excessive loading, buckling, squirming, totally collapsed springs, making permanent contact with lift or sag restraints, or shorted springs and elastomer elements will not be accepted.
 - 3. Level vibration isolator mounts and bases, to attain fully floating equipment suspension under loading conditions of actual operation and adjust restraints.
 - 4. Adjust or replace defective elements as required.
- B. Application of Mounting Types.
 - 1. Mountings: Types scheduled on drawings.
 - 2. Static deflection requirements: Where not indicated, defined in ASHRAE Handbook - HVAC Applications.

END OF SECTION

SECTION 23 0553
MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.01 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For information.
 - 1. Product data.
 - a. Pipe markers.
 - b. Equipment identification labels.

1.02 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Pipe markers shall identify fluid handled by system, and temperature or pressure, if required to distinguish from similar system.
- B. Markers for insulated pipe and for bare pipe sized 1/2 inch and larger shall clearly indicate direction of fluid flow with arrows.
- C. Markers for pipe sized 1/2 inch and larger shall comply with requirements of ASME A13.1, and Owner's scheme for identification of piping systems as follows.
 - 1. Pipe content and marker.
 - a. Sanitary sewer and vent: Yellow field with black letters.
 - b. Domestic cold water: Green field with white letters.
 - c. Irrigation Water: Green field with white letters.
 - d. Domestic hot water: Yellow field with white letters.
 - e. Natural gas: Yellow field with black letters.
 - f. Compressed air: Green field with white letters.
 - g. Fire protection: Red field with white letters.
- D. Pipe Markers.
 - 1. Furnish and apply custom-made pipe markers to piping defined as follows.
 - a. Piping exposed to view.
 - 1) Piping exposed to view includes piping located in equipment rooms or in spaces that do not conceal the piping.
 - b. Piping located above suspended ceilings.
 - c. Piping located in accessible shafts.
 - d. Underground metallic piping.
 - e. Underground nonmetallic piping.
 - 2. Identify fluid handled by each system.
 - 3. Markers for insulated pipe and for bare pipe sized 3/4 inch and larger shall indicate direction of fluid flow.

2.02 MANUFACTURED UNITS

- A. Mechanical Identification (Piping and Ductwork).
 - 1. Markers for pipe sized 3/4 inch and larger.
 - a. Unless otherwise specified, comply with requirements of ASME A13.1.
 - b. Background of markers shall be color coded.
 - c. Legends shall be in long form or they may be abbreviated only if they are in common, everyday usage and not prone to misinterpretation.
 - d. Directional arrows shall point away from legend.
 - e. Plastic and coated to resist smudging and damage from water and weather.

- f. Snap-on or strap-on type.
 - g. Color scheme used on markers for medical gas piping systems in accordance with CGA Pamphlet C-9.
 - h. Acceptable products.
 - 1) W.H. Brady, Quick-Labels.
 - 2) Craftmark Identification Systems, Specmark.
 - 3) Marking Services, Inc.
 - 4) Seton, Setmark.
 - 5) Substitutions: See Section 01 6000 - Product Requirements
- 2. Markers for bare pipe smaller than 3/4 inch nominal size.
 - a. Circular brass tags identifying service and suspended by means of brass jack chains.
 - 1) Legends shall be largest type which can be accommodated.
 - b. Snap-on labels specifically made for small diameter pipe and tubing.
 - c. Acceptable products.
 - 1) W.H. Brady, Style No. 28.
 - 2) Craftmark Identification Systems.
 - 3) Marking Services, Inc.
 - 4) Seton, Valve Tags.
 - 5) Substitutions: See Section 01 6000 - Product Requirements
- B. Equipment Identification and Duplicate Motor Nameplate Data.
 - 1. Laminated white plastic nameplates with black engraved letters.
 - 2. Acceptable manufacturers.
 - a. W.H. Brady.
 - b. Craftmark Identification Systems.
 - c. Marking Services, Inc.
 - d. Seton.
 - e. Substitutions: See Section 01 6000 - Product Requirements

PART 3 EXECUTION

3.01 INSTALLATION

- A. Mechanical Identification (Piping and Ductwork).
 - 1. Apply pipe markers for piping specified to be painted, after painting has been completed.
 - 2. Prior to application of snap-on labels, or brass tags, remove debris and dust from contact surfaces.
 - 3. Unless otherwise specified, locate pipe markers in accordance with Article 3.1 of ASME A13.1, except with 50 foot maximum intervals.
 - 4. Furnish and install markers on piping at connections to equipment.
 - 5. Apply pipe markers for piping specified to be painted, after painting has been completed.
 - 6. Prior to application of pipe markers, snap-on labels or brass tags, remove dust and debris from pipe surface.
 - 7. Install pipe markers as follows.
 - a. At access panels or doors.
 - b. Adjacent to valves and branch connections.
 - c. On both sides of floors, ceilings, and walkways.
 - d. At major changes in direction.
 - e. At maximum intervals of 25 feet on straight lengths of pipe.
 - f. At termination points.
 - g. At connections to equipment.
 - 8. Arrow and marker placement shall furnish unobstructed visibility from floor level.
 - 9. Label ductwork to indicate service, associated fan number, and direction of airflow.
 - 10. Label ductwork after completion of associated insulation and painting.
- B. Mechanical Equipment.
 - 1. Label in accordance with Owner's requirements.

2. When electric motor location renders nameplate data inaccessible, install duplicate motor nameplate data in easily accessible location on equipment.

3.02 FIELD QUALITY CONTROL

- A. Check factory installed nameplates for readability.
 1. Remove paint smears.
 2. Where nameplates are illegible, arrange for replacement by equipment manufacturer.
- B. Check directional arrows and apply corrected labels and arrows, where errors are found.

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Vibration measurement of equipment operating conditions.
- C. Commissioning activities.

1.02 RELATED REQUIREMENTS

- A. Section 23 0800 - Commissioning of HVAC.

1.03 REFERENCE STANDARDS

- A. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2008.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC MN-1, AABC National Standards for Total System Balance.
 - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
 - 3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
 - 4. SMACNA HVAC Systems Testing, Adjusting, and Balancing.
 - 5. Maintain at least one copy of the standard to be used at project site at all times.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Having minimum of three years documented experience.
 - 3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org.
 - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.
- E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.

6. Fans are rotating correctly.
 7. Air coil fins are cleaned and combed.
 8. Air outlets are installed and connected.
 9. Duct system leakage is minimized.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

3.03 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- B. Measure air quantities at air inlets and outlets.
- C. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- D. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- E. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- F. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

3.04 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.

3.05 COMMISSIONING

- A. See Sections 01 9113 and 23 0800 for additional requirements.
- B. Perform prerequisites prior to starting commissioning activities.
- C. Fill out Prefunctional Checklists for:
 1. Air side systems.
 2. Water side systems.
- D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.
- E. In the presence of the Commissioning Authority, verify that:
 1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
 2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
 3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

END OF SECTION

SECTION 23 0700
HVAC DUCT AND PIPING INSULATION

PART 1 GENERAL

1.01 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. Product data.
 - a. Each product and component.
- C. For Closeout.
 - 1. Certificates.
 - a. Fire hazard classification data.
- D. Fire Hazard Classification Data.
 - 1. Submit certifications for interior materials attesting to compliance with specified fire/smoke ratings.
 - 2. Notarized affidavits shall state.
 - a. Name of product, name of nationally recognized testing laboratory, laboratory test number, date and test results.
 - b. Product is installed as tested.

1.02 WARRANTY

- A. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

1.03 SCHEDULES

- A. Ductwork Insulation.
 - 1. Ducts for intake of outdoor air.
 - a. Type DD-1.
 - b. Thickness: 1-1/2 inches.
 - 2. Air conditioning supply ducts (concealed).
 - a. Type DD-2.
 - b. Thickness: 1-1/2 inches.
 - 3. Air conditioning supply ducts (exposed).
 - a. Type DD-1.
 - b. Thickness: 1-1/2 inches.
 - 4. Sheet metal blankoff panels for unused portions of louvers.
 - a. Type DD-1.
 - b. Thickness: 1-1/2 inches.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Drawings indicate equipment locations, related layouts, and general design of systems specified under Division 23.
- B. Include thermal insulation for scheduled systems.
- C. Unless otherwise specified or indicated, insulate surfaces in accordance with insulation schedules specified.

2.02 MATERIALS

- A. General.
 - 1. Include insulating materials having maximum flame spread rating of 25 and maximum smoke developed rating of 50, when tested in accordance with ASTM E84.
 - 2. Rigid fiberglass board insulation in accordance with ASTM C612.
 - 3. Fiberglass blanket insulation in accordance with ASTM C553.
 - 4. Insulating materials UL labeled.

5. Adhesives: Fire resistant in dry state and UL listed.
- B. Ductwork and Sheet Metal Insulation.
 1. Type DD-1, rigid fiberglass board.
 - a. Density: 6 pounds per cubic foot.
 - b. Jacket: UL rated, factory applied, flame retardant, foil-faced reinforced, kraft vapor barrier.
 - c. Thermal conductivity: Not more than 0.22 Btu per hour, per square foot, per degree F, per inch, at 60 degrees F.
 - d. Acceptable products.
 - 1) Knauf, Insulation Board 6 PCF with FSK.
 - 2) Manson, AK Board with FSK.
 - 3) Manville, Type 817 with FSK.
 - 4) Owens-Corning, 705 Series with FRK.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
 2. Type DD-2, flexible, fiberglass duct blanket covering.
 - a. Thermal conductivity: Not more than 0.26 Btu per hour, per square foot, per degree F, per inch, at 75 degrees F.
 - b. Jacket: UL rated, factory applied, vapor barrier.
 - c. Laminated, reinforced aluminum foil faced with flame resistant kraft paper.
 - d. Maximum vapor permeability rating: 0.02 perm.
 - e. Acceptable products.
 - 1) CertainTeed, Standard Duct Wrap with FSK.
 - 2) Knauf, Duct Wrap 1.0 PCF with FSK.
 - 3) Manville, R-Series Microlite with FSKL.
 - 4) Owens-Corning, Faced Duct Wrap Insulation, Commercial Grade Type 100.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
- C. Cements, Adhesives, and Coatings.
 1. Insulating and finishing cement.
 - a. Acceptable products.
 - 1) Celotex, MW-1.
 - 2) Pabco, Pabcote.
 - 3) Fibrex, FBX Superkote.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
 2. Lap adhesive and finish coating for nonvapor barrier applications.
 - a. Acceptable products.
 - 1) Childers, CP-50A.
 - 2) Foster, 30-04.
 - 3) Marathon, 102.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
 3. Vapor barrier lap adhesive and surfacing adhesive.
 - a. Acceptable products.
 - 1) Childers, CP-82.
 - 2) Foster, 85-20.
 - 3) Marathon, 225.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
 4. Lagging and surfacing adhesive for calcium silicate insulation.
 - a. Acceptable products.
 - 1) Childers, CP-97/CP-98.
 - 2) Foster, 81-27/81-93.
 - 3) Marathon, 290.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
 5. Vapor barrier coatings.
 - a. Acceptable products.

- 1) Marathon, 501.
- 2) Childers, CP-30 or CP-32.
- 3) Foster, 30-35.
- 4) Substitutions: See Section 01 6000 - Product Requirements.
6. Outdoor sealing mastic for calcium silicate insulation.
 - a. Acceptable product.
 - 1) Foster, 60-80.
 - 2) Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General Requirements.
 1. Install to present neat, clean appearance.
 2. Apply only after surfaces have been cleaned, inspected, and tested.
 3. Apply neatly, tightly, with unbroken lengths, and with ends of sections firmly butted together.
 4. At joints, lap insulating jackets and cement in position.
 5. Sectional covering shall be uniform.
 6. Where required material thickness is not available, layer insulation, staggering butt joints.
 7. Do not dilute surface finishes and adhesives.
 8. Apply surface finishes and adhesives in accordance with manufacturer's instructions.
 9. Do not apply sealing coats until volatiles have dissipated, and until cements and adhesives have thoroughly dried.
 10. Unless otherwise specified, do not apply second or multiple coats until previous coats have thoroughly dried.
 11. Do not use flame or spark producing equipment in areas where adhesives, mastics, sealants, or coatings containing volatiles are stored or being applied.
 12. Maintain integrity of vapor barriers. Do not use fasteners to secure vapor barrier insulation, which penetrate or damage vapor barrier.
 13. Butt insulation to building construction and to angle iron stops. Where vapor seals or similar facings are required, extend and seal to building construction or angle.
 14. Surfaces to be insulated shall be considered concealed where located in furred spaces or above suspended ceilings, other work shall be considered exposed.
 15. Restore to original likeness existing insulation damaged during progress of the work.
- B. Ductwork and Sheet Metal Insulation.
 1. General.
 - a. Unless otherwise specified or indicated, insulation for ductwork includes insulation for plenums, adapters, transitions, collars, boots, standing seams, stiffeners, angle rings, flanges, and similar components not factory insulated or lined.
 - b. Prior to installation of thermal insulation to faces of sheet metal fabrication inaccessible once installed, install jacket flaps on exposed edges, for overlapping onto accessible portions of insulation.
 - c. At sheet metal joints, maintain vapor barrier on inaccessible insulation by returning and cementing insulation jacketing to sheet metal.
 - d. Where insulation is specified for sheet metal construction located adjacent to lined or covered system portions, overlap lining or lagging by not less than 24 inches.
 2. Type DD-1.
 - a. Install angle iron frames, or approved stops, at doors in plenums or similar openings.
 - b. Finish edges and seams at visible locations in a neat manner.
 - c. Impale insulation on pins. Secure insulation mechanically to sheet metal work in approved manner. On underside ductwork greater than 24 inches wide space fasteners on not greater than 18 inch centers. Hold insulation in place with speed nuts or clips in accordance with manufacturer's recommendations. Cut off protruding ends of fasteners flush with speed clips.

- d. Cover insulation joints with 3 inch wide vapor barrier tape, sealed with vapor barrier lap adhesive.
 - e. Treat punctures in facing of insulation in same manner as joints.
 - f. After insulation is installed on indoor ductwork seal and cover joints and punctures with tack coat of vapor barrier coating at coverage rate of 40 to 50 square feet per gallon. Embed into wet tack coat, a layer of fiberglass reinforcing cloth overlapping by 2 inches at seams. Smooth cloth, eliminating wrinkles. Apply final vapor barrier coating using same coverage rate not later than 1 hour after tack coat.
3. Type DD-2.
- a. Attach insulation to sheet metal work with surfacing adhesive using approximately 50 percent coverage of adhesive, or impale insulation on pins, mechanically secured to sheet metal work in an approved manner.
 - b. Hold in place with speed nuts or clips in accordance with manufacturer's recommendations.
 - c. At joints: Cut fiberglass mat back by 4 inches, on 1 of 2 abutting sections of insulation. Fold remaining vapor barrier jacket flap to double thickness. Apply full coverage of vapor barrier lap adhesive to vapor barrier jacket of adjoining insulation section and staple.
 - d. Apply 4 inch wide brush coat of vapor barrier lap adhesive over joint.
 - 1) Center over folded edge of jacket flap.
 - 2) Apply additional vapor barrier lap adhesive where staple penetrations remain exposed or where fishmouths are evident.

END OF SECTION

SECTION 23 0800
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

- A. See Section 01 9113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 01 9113.
- B. This Section covers Contractor's responsibilities for commissioning; each subcontractor or installer responsible for installation of particular system or equipment item to be commissioned is responsible for commissioning activities relating to that system or equipment item.
- C. Commissioning Authority (CA) directs and coordinates commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.
- D. Entire HVAC system is to be commissioned, including commissioning activities for following specific items:
 - 1. Control system.
 - 2. Major and minor equipment items.
 - 3. Piping systems and equipment.
 - 4. Ductwork and accessories.
 - 5. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
- E. Prefunctional Checklist and Functional Test requirements specified in this Section are in addition to, not a substitute for, inspection or testing specified in other Sections.

1.02 RELATED REQUIREMENTS

- A. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.
- B. Section 23 3100 - HVAC Ducts and Casings.
- C. Section 23 3400 - HVAC Fans.
- D. Section 23 4000 - HVAC Air Cleaning Devices.
- E. Section 23 7400 - Packaged Outdoor HVAC Equipment.
- F. Section 23 8100 - Air Conditioning Equipment.

1.03 REFERENCE STANDARDS

- A. AABC MN-1 - AABC National Standards for Total System Balance; 2002.
- B. ACGIH (IV) - Industrial Ventilation, A Manual of Recommended Practice for Design; 2010, 27th Edition.
- C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; 2011.
- D. ASHRAE Guideline 1.1 - HVAC&R Technical Requirements for the Commissioning Process; 2007 (Errata 2012)
- E. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; 2008 with Errata.
- F. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; 2005, Seventh Edition.
- G. SMACNA 1780 - HVAC Systems Testing, Adjusting, and Balancing; 2002.

1.04 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. Updated Submittals: Keep Commissioning Authority informed of changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

- C. DRAFT Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating procedures to be followed to test, checkout and adjust control system prior to full system Functional Testing; include at least following for each type of equipment controlled:
1. System name.
 2. List of devices.
 3. Step-by-step procedures for testing each controller after installation, including:
 - a. Process of verifying proper hardware and wiring installation.
 - b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
 - c. Process of performing operational checks of each controlled component.
 - d. Plan and process for calibrating valve and damper actuators and sensors.
 - e. Description of expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
 4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when sensor or controller has "passed" and is operating within contract parameters.
 5. Description of instrumentation required for testing.
 6. Indicate what tests on what systems should be completed prior to TAB using control system for TAB work. Coordinate with Commissioning Authority and TAB contractor for this determination.
- D. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.
- E. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum following data on control system:
1. Specific step-by-step instructions on how to perform and apply functions, features, modes, etc. mentioned in controls training sections of this specification and other features of this system. Provide index and clear table of contents. Include detailed technical manual for programming and customizing control loops and algorithms.
 2. Full as-built set of control drawings.
 3. Full as-built sequence of operations for each piece of equipment.
 4. Full points list; in addition to information on original points list submittal, include listing of rooms with following information for each room:
 - a. Room number.
 - b. Room name.
 - c. Air handler unit ID.
 - d. Reference drawing number.
 - e. Minimum air flow rate.
 - f. Maximum air flow rate.
 5. Full print out of schedules and set points after testing and acceptance of system.
 6. Full as-built print out of software program.
 7. Electronic copy on disk of entire program for this facility.
 8. Marking of system sensors and thermostats on as-built floor plan and HVAC drawings with their control system designations.
 9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
 10. Control equipment component submittals, parts lists, etc.
 11. Warranty requirements.
 12. Copies of checkout tests and calibrations performed by Contractor (not commissioning tests).
 13. Organize and subdivide manual with permanently labeled tabs for each of following data in given order:
 - a. Control drawings.

- b. Controller and/or module data.
 - c. Thermostats and timers.
 - d. Sensors and DP switches.
 - e. Dampers and damper actuators.
- F. Project Record Documents: See Section 01 7800 for additional requirements.
 - 1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
 - 2. Show actual locations of static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.
- G. Draft Training Plan: In addition to requirements specified in Section 01 7900, include:
 - 1. Follow recommendations of ASHRAE Guideline 1.1.
 - 2. Control system manufacturer's recommended training.
 - 3. Demonstration and instruction on function and overrides of local packaged controls not controlled by HVAC control system.
- H. Training Manuals: See Section 01 7900 for additional requirements.
 - 1. Provide three extra copies of controls training manuals in separate manual from O&M manuals.

1.05 QUALITY ASSURANCE

- A. Furnish services of independent test and balance agency which meets one of 2 sets of qualifications specified below, and is accepted by Owner and Architect-Engineer.
 - 1. Assign to this agency responsibility for balancing, adjusting, and testing of systems necessary for attaining flow rates, pressures, pressure differentials, and pressure relationships indicated.
 - 2. Furnish and install additional items required for testing, adjusting, and balancing as recommended by agency.
 - 3. Agency shall perform work in accordance with requirements specified in this Section.
 - 4. Qualification Set No. 1.
 - a. Agency shall be known to offer services limited to balancing, adjusting, and testing of air systems.
 - b. Agency shall assign engineer or manager as job supervisor with full job responsibilities.
 - c. Agency shall be certified member in good standing of AABC or NEBB, and be certified for systems test and balance work specified.
 - 5. Qualification Set No. 2.
 - a. Agency shall be fabricator and installer of mechanical systems similar to mechanical systems to be tested, but shall not be party to Contract for manufacture, fabrication, installation, processing, sale or lease of materials, supplies, accessories, equipment, or devices associated with work of this Project.
 - b. Agency shall be certified member in good standing of NEBB, and be certified for systems test and balance work specified.
- B. Test Reports.
 - 1. Test data forms shall be forms prepared by agency listed under heading, Reference Standards, and submitted completely filled out.
 - 2. If computers are used for calculations and data printouts, standard computer test data forms may be used, if required information is included.
 - 3. Submit these forms and explanation of computer program for acceptance prior to use.
 - 4. Prior to final acceptance, submit 6 copies of test and balance report forms for review by Architect-Engineer.
 - 5. Neatly typed or printed.
 - 6. Submit final test reports, accepted and signed, for each system, including as minimum.
 - a. Table of contents.
 - b. Summary report.
 - c. Identify each system for type and location.

- d. Identify and list type, size, location, flow factor, and manufacturer of inlets, outlets, flow measuring devices, and equipment, as well as associated design and actual flow rates, both at maximum, minimum, and partial airflow rates where applicable.
 - e. Furnish performance data sheets for equipment, including curves and operating information.
 - f. Obtain data prior to start of work and mark operating setpoints for record.
 - g. Design and actual temperatures, pressures or differential pressures for each piece of equipment and for each section of system.
 - h. Applicable test data forms completely filled out.
 - i. Operating conditions of systems.
 - j. Atmospheric conditions or conditions of the building or associated systems that have had an effect on results of work.
 - k. Modes of operation, if more than one.
 - l. Measurements and checks used to ensure accuracy of data obtained and that tolerances were met.
 - m. Methods or formulas and references used for correcting measured readings.
 - n. Information useful in analysis of test results.
 - o. Certified documentation of instrument calibrations.
- C. Definitions.
- 1. Testing, to determine quantitative performance of equipment.
 - 2. Balancing, to establish specific volumes of flow within distribution system.
 - 3. Adjusting, to regulate specified flow rates and air patterns.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

- A. Provide standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become property of Owner.
- B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to piece of equipment, are only available from vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of work at no extra cost to Owner; such equipment, tools, and instruments are to become property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

- A. Cooperate with Commissioning Authority in development of Prefunctional Checklists and Functional Test Procedures.
- B. Furnish additional information requested by the Commissioning Authority.
- C. Prepare preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by Commissioning Authority; update schedule as appropriate.
- D. Notify Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that Commissioning Authority has scheduling information needed to efficiently execute commissioning process.
- E. Put HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
- F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with approved plug.
- G. Provide temperature and pressure taps in accordance with Contract documents.

3.02 INSPECTING AND TESTING - GENERAL

- A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.
- B. Perform Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.
- C. Valve/Damper Stroke Setup and Check:
 - 1. For valve/damper actuator positions checked, verify actual position against control system readout.
 - 2. Set pump/fan to normal operating mode.
 - 3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
 - 4. Command valve/damper open; verify position is full open and adjust output signal as required.
 - 5. Command valve/damper to a few intermediate positions.
 - 6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
- D. Isolation Valve or System Valve Leak Check: For valves not by coils.
 - 1. With full pressure in system, command valve closed.
 - 2. Use ultra-sonic flow meter to detect flow or leakage.
- E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

- A. TAB: Testing, adjusting, and balancing of HVAC.
- B. Coordinate commissioning schedule with TAB schedule.
- C. Review TAB plan to determine the capabilities of control system toward completing TAB.
- D. Provide necessary unique instruments and instruct TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.
- E. Have required Prefunctional Checklists, calibrations, startup and component Functional Tests of system completed and approved by Commissioning Authority prior to starting TAB.
- F. Provide qualified control system technician to operate controls to assist TAB technicians or provide sufficient training for TAB technicians to operate system without assistance.

3.04 TAB - GENERAL REQUIREMENTS

- A. Perform testing and balancing methods and procedures in accordance with one or more standards specified under heading, Reference Standards, and in presence of Architect-Engineer.
- B. Additionally, perform testing and balancing recommended by product manufacturers.
- C. Unless otherwise specified, furnish labor, materials, test instruments, ladders, scaffolding, extension cords, tools, and equipment necessary for complete testing, balancing, and adjusting of systems or equipment in the Contract Documents.
- D. Prepare and submit test and balance report.
- E. Wherever possible, cross-check readings with additional readings to ascertain that required flow rate is attained.
- F. Prior to start of work, review drawings and Specifications, and if systems may present difficulties in achieving required balanced flow conditions, notify Architect-Engineer.
- G. If, during course of work, criteria cannot be met, immediately advise Architect-Engineer prior to proceeding with work.
- H. Use of orifice plate to balance airflow in air distribution systems instead of air balancing dampers is prohibited.

1. This does not preclude use of perforated plates to attain uniform air distribution.
- I. Use of orifice plates to balance flow capacities in liquid systems is prohibited, unless indicated on the drawings.
- J. Instruments used shall have unexpired calibration dates.
 1. Calibration date and date of expiration shall be noted on tag affixed to each instrument.
 2. Submit letter of certification of instrument calibrations as part of final report.
 3. Recalibrate instruments that are dropped or subjected to severe jarring.
- K. Furnish sufficient number of each type of instrument, in order to avoid delays.
- L. In systems with redundant equipment, independently test and adjust each piece of equipment to operate within design criteria.
- M. After final adjustment in primary mode, secondary modes shall be tested and system data recorded.
- N. Coordinate systems test and balance work with systems installation.
- O. After final adjustment, permanently mark position of balancing devices equipped with external means of setting position.
- P. During start-up and initial operation, field measurements may be made by Architect-Engineer, Owner, or Owner's consultant.
- Q. If it is determined that submitted test data do not agree with these field measurements, within allowable tolerances, retest and rebalance portions of work found in contention.

3.05 TAB - AIR DISTRIBUTION SYSTEMS REQUIREMENTS

- A. Test, balance, and adjust air distribution systems, equipment, components, and system related items to accomplish design objectives.
- B. Note air mixing dampers regarding operation, location, and damper blade orientation for compliance with information on drawings.
 1. Check air flow within intake plenums and mixing boxes of air handling units for uneven flow and temperature stratification and prepare report with profile elevations (temperature and velocity) on each coil or filter face for Architect-Engineer.
 2. In some cases, direction of nonducted air movement from rooms under positive or negative pressure is more relevant than exact airflow rates.
 3. Direction of nonducted air flows, including air distribution pattern over entire door opening, shall be verified by use of smoke tubes with results recorded on data sheets.
 4. Coordinate installation and replacement of dampers or devices required for balancing.
 5. Mark final fix setting of volume dampers by drilling and pinning the handles with sheet metal screws.
- C. Perform testing and adjusting of terminal units and devices in accordance with manufacturer's instructions or in accordance with procedures established by one or more of system's test and balance standards at maximum, minimum, and intermediate load conditions.
- D. Air distribution systems shall be tested, balanced, and adjusted under following operating conditions.
 1. Supply, return, and exhaust systems operating.
 2. Doors, windows, hatches, and similar openings closed or in a position to reflect projected operating conditions.
 3. Systems that may affect system being tested shall be operating at near design flow and temperatures.
 4. Whenever possible, final readings and settings shall be made with coils operating (wet).
 5. Systems shall operate at design airflow rates with simulated air resistance for 75 percent of dirty filter condition.
 6. Furnish blankoff panels over filters as required to achieve simulation.
- E. Comply with equipment manufacturer's published recommendations and procedures in testing, balancing, and adjusting of device or system.

- F. Obtain manufacturer's data on installed air handling equipment.
- G. Adjust total system airflow rates by changing fan speed, inlet vane position, or fan blade position.
 - 1. Use fan speed as primary adjustment to ensure maximum system efficiency.
 - 2. Select required sheave sizes and advise installing Contractor to change drive sheaves accordingly.
 - 3. Retest system after fan speed changes or adjustments have been made.
- H. Adjust systems with different outside air capacities for winter and summer operating modes with winter as primary operating mode, and summer as secondary operating mode.
- I. Balance branch duct airflow rates with volume dampers.
- J. Use dampers that are integral with terminal devices for minute final adjustments only.
- K. Adjust outside air, return air, and exhaust dampers by using direct flow readings.
- L. Where direct flow readings are impossible or of questionable accuracy, use mixed air temperature method.
- M. Air Distribution Systems Measurements.
 - 1. Perform measurement and adjustment of airflow rates, temperatures, and pressures for duct systems and components in accordance with following requirements.
 - a. Measure air flow in main ducts, branch ducts carrying 10 percent or more of total system capacity, or individual outlets where manufacturer's outlet factor is unknown, by pitot tube, micromanometer, or hot wire anemometer traverses of duct.
 - b. For velocities below 500 fpm, use micromanometer with minimum resolution 0.001 inch water gauge.
 - c. Drill test holes in ducts and seal them with removable, leaktight plugs, suitable for 30 inch water gauge positive or negative pressure.
 - d. Pitot traverses shall be made with pitot tube and inclined manometer or calibrated differential pressure gauge.
 - e. Traverses shall be made in duct sections having minimum of 4 diameters in length from nearest transition or obstruction.
 - f. In cases where it is impossible to obtain velocity traverses in duct, use difference of 2 traverses in adjoining ducts of branch or sum of individual diffuser volumes to determine total duct volume.
 - 2. Measure air flow from supply or return outlets by one or more of following methods.
 - a. Measuring velocities at locations recommended by outlet manufacturer.
 - 1) Apply manufacturer's area or K factor to determine flow.
 - b. Applying calibrated hood or cone and measuring velocity at outlet of hood or cone.
 - 1) Size hoods or cones to limit their outlet velocity to maximum of 650 fpm.
 - 2) Apply hood or cone correction factor to determine flow.
 - c. Averaging anemometer readings taken in sections across outlet face.
 - 1) Mark off outlet in sections and take stationary readings in front of each section.
 - 2) Apply manufacturer's area factor to determine flow.
 - 3. Measure air flow through device as follows.
 - a. Measurement of flow through coil, filter, louver, damper, or similar device shall be made by velocity traverse or measuring pressure drop across device.
 - b. Device shall be clean of dirt or obstructions before measurements are taken.
 - c. Manufacturer's data on free area or pressure drop should be known or carefully calculated to determine actual flow.
 - d. Determine average velocity by individual readings at set intervals.
 - e. Make velocity traverses with hot wire type or 4 inch vane type anemometer attached to long handle.
 - f. For velocities below 100 fpm, use hot wire anemometer.
 - g. Individual spot readings at set intervals shall be to establish average velocity.

- h. To obtain flow rate, multiply velocity by free area of device or by total area and free area factor.
- i. Flow determined by these methods may be used as check against pitot traverses or as actual flow delivered when it is impossible to obtain proper pitot traverse.
- 4. Make static or total pressure measurements as follows.
 - a. To determine static or total pressures in ductwork, plenum chambers, fans, filters, coils, and similar devices, use inclined manometer or calibrated differential pressure gauge in conjunction with appropriate pressure tips.
 - b. Take 2 or more readings.
 - c. Measure and record pressures to nearest 0.01 inch water gauge.
 - d. Use inclined manometer or calibrated differential pressure gauge of proper range to measure differential pressures between spaces or between space and fixed reference pressure.
 - e. Measure and record differential pressures to nearest 0.01 inch water gauge.
- 5. Measure temperatures with electronic thermometer, calibrated dial thermometer of one percent accuracy, or glass stem, liquid filled thermometer with minimum of one degree graduations.
- 6. Measure air temperatures at single point well within airstream or, if stratification is present, by averaging readings of multiple point traverse.
- 7. Measure and record temperatures to nearest degree F.
- 8. Measure amperage with clamp-on meter.
 - a. Measure voltages across line.
 - b. On 3 phase devices, take readings on 3 legs.
 - c. Where available, make readings at open terminals of operating device.
- 9. Measure fan and motor rpm with automatic tachometer or stroboscopic tachometer, taking minimum of 2 readings.

3.06 CONTROL SYSTEM FUNCTIONAL TESTING

- A. Prefunctional Checklists for control system components will require signed and dated certification that system programming is complete as required to accomplish requirements of Contract Documents and detailed Sequences of Operation documentation submittal.
- B. Do not start Functional Testing until controlled components have themselves been successfully Functionally Tested in accordance with Contract documents.
- C. Using skilled technician who is familiar with this building, execute Functional Testing of control system as required by Commissioning Authority.
- D. Functional Testing of control system constitutes demonstration and trend logging of control points monitored by control system.
 - 1. Scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
 - 2. Perform trend logging specified in Prefunctional Checklists and Functional Test procedures.
- E. Functionally Test integral or stand-alone controls in conjunction with Functional Tests of equipment they are attached to, including interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.
- F. Demonstrate following to Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
 - 1. Setpoint changing features and functions.
 - 2. Sensor calibrations.
- G. Demonstrate to Commissioning Authority:
 - 1. That specified functions and features are set up, debugged and fully operable.
 - 2. That scheduling features are fully functional and setup, including holidays.
 - 3. That graphic screens and value readouts are completed.
 - 4. Correct date and time setting in central computer.

5. That field panels read same time as central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
 6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test remaining units without extra cost to Owner.
 7. Power failure and battery backup and power-up restart functions.
 8. Global commands features.
 9. Security and access codes.
 10. Occupant over-rides (manual, telephone, key, keypad, etc.).
 11. O&M schedules and alarms.
 12. Occupancy sensors and controls.
 13. Control strategies and sequences not tested during controlled equipment testing.
- H. If control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of conditions, sequences, or modes tested, correct systems, equipment, components, and software required without additional cost to Owner.

3.07 SYSTEMS COMMISSIONING

- A. Following completion of construction, implement commissioning plan generally in accordance with ASHRAE Guideline 1.1.
- B. Prepare guideline plan for commissioning, including following.
 1. Witness pressure tests on piping and ductwork.
 2. Witness system and equipment start-up.
 3. Witness flushing and cleaning activities.
 4. Review design drawings and equipment schedules.
 5. Review Construction Documents.
 6. Review control diagrams.
 7. Review operating and maintenance instructions.
 8. Develop, complete, witness, and certify acceptance documents for each piece of equipment, and for each system.
- C. Complete commissioning work including.
 1. Document and certify equipment start-up and testing.
 2. Complete airflow and hydronic system adjusting and balancing.
 3. Complete functional performance tests and record concurrent weather data for each system in all modes of operation including.
 - a. Summer/winter.
 - b. Occupied/unoccupied.
 - c. Warm up/cool down.
 - d. Day/night.
 - e. Full load/part load.
- D. Performance tests include measurement of flow, pressure, speed, temperature, velocity, noise, vibration, and other data required to establish operation of equipment and systems.
- E. Cycle controls and activities through complete range and operating sequence.
- F. Test, calibrate, and verify control component operation.
- G. Record design and operating sequence test.
- H. Furnish maintenance instruction and training for Owner's personnel in conjunction with equipment manufacturer and controls suppliers.
- I. Furnish complete documentation and report on final system operation, including signed certificates of completion for turnover of equipment and systems.

3.08 OPERATION AND MAINTENANCE MANUALS

- A. See Section 01 7800 for additional requirements.
- B. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- C. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.09 DEMONSTRATION AND TRAINING

- A. See Section 01 7900 for additional requirements.
- B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during demonstration, system fails to perform in accordance with information included in O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.
- C. These demonstrations are in addition to, and not substitute for, Pre-functional Checklists and demonstrations to Commissioning Authority during Functional Testing.
- D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of HVAC system, control system, and equipment items indicated to be commissioned. Provide following minimum durations of training:
- E. TAB Review: Instruct Owner's personnel after completion of TAB, on following:
 - 1. Review final TAB report, explaining layout and meanings of each data type.
 - 2. Discuss outstanding deficient items in control, ducting or design that may affect proper delivery of air or water.
 - 3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
 - 4. Discuss temporary settings and steps to finalize them for areas that are not finished.
 - 5. Other salient information that may be useful for facility operations, relative to TAB.
- F. Provide services of manufacturer representatives to assist instructors where necessary.
- G. Provide services of HVAC controls instructor at other training sessions, when requested, to discuss interaction of controls system as it relates to equipment being discussed.

END OF SECTION

SECTION 23 1008
HANGERS AND SUPPORTS FOR HVAC

PART 1 GENERAL

1.01 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop drawings.
 - a. Pipe hanger and support installation details, including details and locations of seismic or sway bracing, pipe anchors, and anchor bracing.
 - b. Include dimensioned location and method of attachment to building structure.
 - c. Where pipe hangers cannot be hung from building structure, submit proposed method of installing additional structural steel that connects to the building structure.

1.02 QUALITY ASSURANCE

- A. Qualifications.
 - 1. Supplemental steel welding procedures, in accordance with section, Qualification, of AWS D1.1.
 - 2. Only welders who have successfully passed examination for this class of work shall be employed to execute structural strength welds.
 - 3. Examination shall have been within the past six months, unless welder has been making this type of weld after passing test within two years, as specified under qualification procedures of AWS D1.1.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Adjustable Swivel Ring Hangers.
 - 1. Heavy steel construction with swivel nut and locknut.
 - 2. Acceptable products.
 - a. B-Line, Fig. B3170.
 - b. Carpenter and Paterson, Fig. 800.
 - c. Anvil International Inc. (Grinnell), Fig. 70.
 - d. Michigan Hanger Co., No. 100.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- B. Clevis Hangers.
 - 1. Heavy steel with adjustable nut and locknut.
 - 2. Include spreaders on cross bolts of hangers for pipe sized 10 inches and larger.
 - 3. Acceptable products.
 - a. B-Line, Fig. B3100.
 - b. Carpenter and Paterson, Fig. 100.
 - c. Anvil International Inc. (Grinnell), Fig. 260.
 - d. Michigan Hanger Co., No. 400.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- C. Beam Clamps for Pipe 2 Inches and Smaller.
 - 1. Side type.
 - a. Acceptable products.
 - 1) B-Line: Fig. B3045.
 - 2) Carpenter and Paterson: Fig. 18.
 - 3) Supply Sales (Grinnell): Fig. 217.

- 4) Michigan Hanger Co.: No. 367.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
2. Side I type.
 - a. Acceptable products.
 - 1) Carpenter and Paterson: Fig. 45.
 - 2) Supply Sales (Grinnell): Fig. 225.
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
3. Adjustable type.
 - a. Acceptable products.
 - 1) B-Line: Fig. B3040.
 - 2) Carpenter and Paterson: Fig. 14.
 - 3) Supply Sales (Grinnell): Fig. 14.
 - 4) Michigan Hanger Co.: No. 363.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
- D. Beam Clamps.
 1. For pipe sized 24 and 30 inches, with weldless eye nuts.
 - a. Acceptable products.
 - 1) B-Line: Fig. B3291 through Fig. B3297.
 - 2) Carpenter and Paterson: Fig. 297.
 - 3) Supply Sales (Grinnell): Fig. 292.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- E. Hanger Rods.
 1. Threaded, hot rolled, steel rod conforming to ASTM A36 or A575.
 2. Hanger rod may be continuously threaded.
 3. Use of rod couplings is prohibited.

2.02 MATERIALS

- A. Pipe Hanger and Supporting Materials.
 1. Represent minimum requirements for mechanical work in general.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install hanger and supporting materials in accordance with specified requirements, and in accordance with seismic requirements dictated by local codes and governing authorities.
 1. Submit typical details and locations for review.
- B. C-clamps without retainer clips and heat-treated spring steel clips that bite into building steel are prohibited as means of fastening pipe hangers to building structure.
- C. Clamps that result in eccentric loads (twisting moments) on structural members of building, except for piping sized 2 inches and smaller, are also prohibited.
- D. Support piping from building structural frame, not from roof deck, permanent metal forms for concrete floors, reinforced concrete slab (unless indicated otherwise), or from other pipe, duct, or equipment.
- E. Contractor's attention is directed to drawing details and building structural framing layout that may require hanger spacing more frequently than spacings shown in table below.
 1. Loading at any support point shall not exceed 1000 pounds, unless specifically indicated otherwise.

<u>Pipe Size</u>	<u>Maximum Hanger Spacing</u>	<u>Minimum Rod Size</u>
1/2 to 1 inch	8 feet	3/8 inch
1-1/4 through 2 inches	10 feet	3/8 inch
2-1/2 to 3-1/2 inches	12 feet	1/2 inch
4 and 5 inches	16 feet	5/8 inch
6 inches	16 feet	3/4 inch
8 and 12 inches	XX feet	X inch
14 and 16 inches	XX feet	X inch
18 and 20 inches	XX feet	X inch
24 and 30 inches	XX feet	X inches

<u>Pipe Size</u>	<u>Maximum Hanger Spacing</u>	<u>Minimum Rod Size</u>
1/2 to 1 inch	8 feet	3/8 inch
1-1/4 through 2 inches	10 feet	3/8 inch
2-1/2 to 3-1/2 inches	12 feet	1/2 inch
4 inches	12 feet	5/8 inch
5 inches	14 feet	5/8 inch
6 inches	14 feet	3/4 inch
8 inches	XX feet	X inch
10 and 12 inches	XX feet	X inch
14 and 16 inches	XX feet	X inch
18 and 20 inches	XX feet	X inch
24 and 30 inches	XX feet	X inches

<u>Pipe Size</u>	<u>Maximum Hanger Spacing</u>	<u>Minimum Rod Size</u>
1 inch and smaller	5 feet	3/8 inch
1-1/4 and 1-1/2 inches	7 feet	3/8 inch
2 inches	10 feet	3/8 inch
2-1/2 through 3-1/2 inches	10 feet	1/2 inch
4 inches	10 feet	5/8 inch

- F. Uninsulated Piping.
1. Smaller than 4 inches: Install adjustable swivel ring type or clevis type hangers.
 2. 4 inches and larger: Clevis type hangers.
- G. Insulated Piping.
1. Smaller than 4 inches: Install adjustable swivel ring or clevis type hangers with preinsulated hanger insert.
 2. Cold pipe 4 inches and larger: Install clevis type hangers with preinsulated hanger insert.
 3. Hot pipe 4 and 5 inches: Install single-rod roller type hangers with preinsulated hanger insert.
 4. Hot pipe 6 inches and larger: Install 2-rod roller type hangers with preinsulated hanger insert.
 5. On roof, sized 1 inch and larger: Install pipe rolls with preinsulated hanger insert.
 6. Hang dual temperature pipe same as specified for hot pipe.
- H. Pipes Supported Individually From Structural Steel.
1. Support horizontal pipes running perpendicular to steel joists or trusses, building roof purlins or floor beams (not T's) by means of beam clamps.

2. Beam clamps for supporting pipe sized 2 inches and smaller, hung from steel joists or trusses, purlins or floor beams, (not T's) may be one of following:
 - a. Side beam clamp.
 - b. Side I-beam clamp.
 - c. Adjustable beam clamp.
 3. Beam clamp size required for given pipe size is scheduled on drawings.
 4. Support horizontal pipes running parallel to steel joists or trusses, purlins or floor beams (not T's) as specified above for piping running perpendicular, except where vertical truss member precludes hanging from purlin in concentric manner. Under these circumstances, support piping as specified for trapeze supports.
- I. Trapeze Supports.
1. Trapeze supports may be used to support one or more pipes grouped together and hung from building steel as detailed on drawings.
 2. Select beam clamp size and corresponding rod size for given trapeze support so as not to exceed loads scheduled on drawings.
 3. As option to hanging piping from trapeze support using hanger devices specified, trapeze support below piping may be used.
 - a. When this option is used, secure uninsulated pipe to trapeze support with standard U-bolts and locknuts.
 4. Install insulated cold pipe with insulating saddle and shield, and secure to trapeze support with standard U-bolt and locknut.
 5. Cradle insulated hot pipe in an adjustable cast iron roller support.
- J. Vertical Pipe Supports.
1. Support vertical runs of uninsulated or insulated cold pipe not subject to appreciable expansion with wrought steel clamps securely clamped to risers.
 2. Support insulated hot pipe subject to vertical expansion by same wrought steel clamp, securely clamped to riser and attached to springs to absorb vertical deflection without appreciable loss of supporting effort.
 3. Support and laterally brace at each floor level, but at intervals not to exceed 16 feet.
- K. Where necessary for proper system functioning, brace piping and supports against reaction sway and vibration.
- L. For concentrated loads such as valves, reduce allowable span proportionately.
- M. Support vertical risers independently of connected horizontal piping whenever practical, with fixed or spring supports at base and at intervals to accommodate system range of load and thermal conditions, and guided for lateral stability.
1. Install only one rigid support for risers subjected to expansion at approximately 1/3 point from top, unless otherwise indicated.
 2. For horizontal piping contiguous to moving risers, two supports nearest to riser shall be spring supports, unless otherwise indicated.
- N. After piping systems have been installed, tested, and placed in satisfactory operation, firmly tighten hanger rod nut and jam nut and upset threads to prevent the movement of fasteners.
- O. Welding to Building Structure.
1. Welding to building structure is not allowed, unless otherwise specified or specifically accepted by Architect-Engineer
 2. If so specified or accepted, comply with following requirements.
 - a. Unless otherwise noted, welding and workmanship shall be governed by AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings in conjunction with AWS D1.1.
 - b. Allowable stresses in field applied welds using E70 Series and A36 steel.
 - 1) Tension or compression, same as base metal.
 - 2) Shear: 15,800 pounds per square inch.

- P. Surfaces to be welded shall be free from loose slag, scale, rust, grease, paint, or other foreign material.
- Q. Before welding, painted surfaces shall have paint removed to expose clean steel surface.
 - 1. Special attention is called to requirement that maximum size of fillet weld that may be assumed in design of connection shall ensure that stresses in adjacent base material do not exceed allowable value for this material.
- R. No welds transmitting calculated stress shall be less than 3 inches in length, and no intermittent welds shall be less than 2 inches in length.
- S. No welds shall be applied to flanges of tension members perpendicular to direction of stress.
- T. Turn side and end fillet welds around corners for minimum length of twice nominal size of weld.
- U. Length of end returns is not to be included in calculated weld length.
- V. No welding or other operation involving use of flame, arcs, or sparking devices will be allowed without written permission of Owner's Field Representative.
- W. Welds found to be in nonconformance to requirements of AWS D1.1 shall be repaired or replaced according to workmanship section of AWS D1.1 without cost to Owner.

END OF SECTION

SECTION 23 3400

HVAC FANS

PART 1 GENERAL

1.01 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop Drawings.
 - a. Prefabricated roof curb.
- C. For Information.
 - 1. Product data.
 - a. Small centrifugal fan.
 - b. In-line centrifugal fan.
 - c. Sidewall exhaust fan (propeller).
 - 2. Performance data.
 - a. Each specific type of fan, including.
 - 1) Scheduled operating condition octave band sound power data.
 - 2) Performance curves.

1.02 QUALITY ASSURANCE

- A. Quality control provisions of Division 01, General Requirements, apply to this Section.
- B. Obtain reviews, except reviews required for field installation, field applications, and field tests, before delivery of items of material, equipment, or systems to project site.
- C. Certificates of Conformance.
 - 1. Submit certificates of conformance or certified tests, in triplicate, attesting that equipment and materials meet specified requirements.
- D. Factory Test Reports.
 - 1. Submit certified copies of reports of factory tests required in referenced publications or specified in Contract Documents.
 - 2. Testing of products proposed shall be done by manufacturer or by accepted independent laboratory.
 - 3. Test reports shall be accompanied by certificates from manufacturer, certifying that tested product is of same type, quality, manufacture, and make as that proposed for this project.
- E. Submit fan weight information and load carrying capabilities of roof curbs. Where fan configuration results in uplift forces, state maximum values of uplift forces acting on curb.
- F. If attachment to support steel is required, submit details on support steel attachment system.
- G. Submit report on existing fan inspection indicating repairs needed, nature of defect and defects found, proposed method or methods of repair or replacement, and Owner's cost of associated labor and material.
- H. Submit safety cable details indicating size of cable and showing method of attachment to motor and building.
- I. Perform work in conformance with Occupational Safety and Health Act (OSHA) and its amendments.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.
- B. Deliver.
 - 1. Do not lift fans by placing slings over fan blades or shaft ends.
 - 2. Do not drop fans off truck beds.
- C. Store.

1. Store fans in manner to prevent windmilling.
2. Rotate shafts periodically to prevent puddle corrosion of bearing races.
3. Close openings to prevent entry of dirt and foreign matter.
4. Protect bearings from corrosion and contamination.
5. Protect each brand and type of bearing as specifically recommended by manufacturer.

1.04 WARRANTY

- A. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. General Fan Requirements.
 1. Furnish fans with certified performance ratings in accordance with AMCA 210 and bearing AMCA Certified Rating label.
 2. Refer to drawings for fan sizes and capacities.
 3. Airflow rates indicated are based on standard air, unless noted otherwise.
 4. Fan selections are subject to review of fan operating characteristics.
 5. Submit performance curves for each fan selection.
 6. Superimpose system curves on each fan curve.
 7. Selections close to point of unstable operation (not sufficiently to right of peak) will not be accepted.
 8. Fan performance shall allow static pressure associated with operating condition to be less than static pressure corresponding to No Flow condition.
 9. Air delivery rate associated with fan's operating condition shall exceed rate of air delivery corresponding to maximum static efficiency.
 10. When operating at speed corresponding to scheduled performance, but when developing static pressure 15 percent in excess of scheduled value, associated rate of air delivery shall not be less than 85 percent of scheduled air delivery rate.
 11. Submit octave band sound power data for each type of fan at scheduled operating condition and tested in accordance with AMCA 300.
 12. Fans will not be accepted if submitted sound power data were derived from generalized information available in literature rather than from actual tests of specific model manufacturer proposes to furnish.
 13. Where required for safety, factory equip fan inlets or outlets, not connected to ductwork or in cabinets, with OSHA approved screens for applicable screen-to-fan blading distances.
 14. Statically and dynamically balance fan wheel after assembly.
 15. Paint fan components inside and outside in manufacturer's standard finish.
 16. Coat components not painted with weather resistant dressing.
- B. Motors.
 1. In accordance with requirements specified in Section 23 0500.
 2. Furnish motor mounts suitable for adjusting drive belt tension and alignment.
- C. Fan Shafts.
 1. Selection determined by applicable wheel, bearing, and pulley loads.
 2. Speed required for scheduled point of operation shall not exceed 80 percent of lowest critical speed.
- D. Fan Bearings.
 1. Heavy-duty ball or roller type selected in accordance with AFBMA 9 or 11 standard rating method using an L-10 Rating Life of 40,000 hours at maximum design speed for each AMCA fan class.
 2. 90 percent of bearings shall complete or exceed this Rating Life before failure.
 3. Average life: Not be less than 200,000 continuous life hours.
 4. Acceptable products.
 - a. Fafnir, Type SAOL.
 - b. SKF, Type SAF.

- c. Substitutions: See Section 01 6000 - Product Requirements
- 5. Lubricators.
 - a. Furnish automatic injection lubricators for fan bearings.
 - b. Acceptable product.
 - 1) Lubesite No. 205.
- E. Disconnect Switches For Roof Mounted Fans.
 - 1. Factory equip each roof exhaust fan with NEMA 3R disconnect switch, electrical wiring between switch and fan motor, and motor lead wiring with liquidtight conduit, unless otherwise indicated or specified.
 - 2. Refer to Division 26 for wiring, conduit, and electrical component requirements.
 - 3. 3 phase motors: Furnish unfused disconnect switches housed in NEMA 3R raintight enclosures.
 - 4. Single phase motors: Furnish manufacturer's standard, UL listed, safety disconnect switches.
 - 5. Furnish corrosion resistant bolts, washers, and nuts.
- F. Special Construction Features and Surface Coatings.
 - 1. Refer to equipment schedule on drawings for requirements.
 - 2. Where indicated, furnish fans equipped with integral, ventilated, weatherproof covers over motors, drives, shafts, and bearings.
 - 3. Where indicated, furnish AMCA Type B spark resistant fans with nonferrous wheel and rubbing ring.
 - 4. Where indicated, furnish fan housings, fan wheels, and shafts, exposed to exhaust air stream, with baked Heresite coating.
 - 5. Where indicated, furnish access doors formed to fit curvature of fan scroll and equipped with gaskets, quick opening latches, and flush with inside of fan scroll.
 - 6. Where indicated, furnish scroll drain coupling tapped for iron pipe size thread.
- G. Safety Cables.
 - 1. Where indicated, furnish steel rope type safety cable secured to motor for attaching to building structure.
 - 2. Size cable to support total weight of motor.
- H. Fan Drives and Guards.
 - 1. Furnish V-belt fan drives, including sheaves and belts, designed and dimensioned in accordance with ISO 1813, 4183, and 4184.
 - 2. Furnish statically and dynamically balanced, cast steel sheaves with interchangeable tapered bushings.
 - 3. Die-cast pulleys or pulleys assembled of stamped and die-formed steel plates are prohibited.
 - 4. Furnish standard-duty sheaves selected to furnish excess capacity of 50 percent overload for loads of less than 3 hp, and excess of 25 percent for loads of 3 hp and greater.
 - 5. Drives over 2 hp, multiple V-belt type.
 - a. V-belts: Static conducting and not smaller than Size B.
 - b. Each drive over 2 hp: Not less than 2 belts.
 - c. Belt speed: Range of 1000 to 5000 fpm.
 - d. Motors up through 5 hp: 1.5 service factor.
 - e. Larger motors: 1.3 service factor.
 - 6. Determine number of V-belts from motor horsepower, applying service factor to obtain design horsepower.
 - 7. Determine corrected horsepower per belt by multiplying nominal horsepower per belt by arc of contact factor (not greater than 0.85).
 - 8. Divide design horsepower by corrected horsepower per belt to obtain number of belts required.
 - 9. Belts.
 - a. Static conducting, heat resistant belts, furnished in matched sets.

- b. Raw edge or steel cable reinforced belts will not be accepted.
- c. Furnish OSHA approved, sectionalized belt guard equipped with 1-1/2 inch diameter minimum tachometer access openings located at center of fan and motor shafts.
- d. Acceptable manufacturers.
 - 1) Dayco.
 - 2) Dodge/Reliance Electric.
 - 3) Eaton.
 - 4) Gates Rubber.
 - 5) Morse Industrial, Emerson Power Transmission Corp.
 - 6) T.B. Wood and Sons.
 - 7) Worthington.
 - 8) Substitution: See Section 01 6000 - Product Requirements.
- I. Sidewall Exhaust Fans (Propeller).
 - 1. Direct driven, with deep spun venturi orifice, wire fan guard, phosphatized panels finished with enamel coating, and backdraft damper.
 - 2. Furnish and install welded, 16 gauge steel mounting frame and supports, and wire screen on discharge.
 - 3. Acceptable products.
 - a. Acme, Dynamaster.
 - b. Bayley, Series MBP Venturi Panel Fans.
 - c. Buffalo Forge, Breezo.
 - d. Greenheck, Model SBE.
 - e. Industrial Air, Panel Venturi Fans.
 - f. Penn Ventilator, Breezeway.
 - g. Substitutions: See Section 01 6000 - Product Requirements.
- J. Prefabricated Roof Curbs.
 - 1. Furnish curbs formed to cross section indicated on drawings, with horizontal top surface, deck slope built into base, complete with wood insulation, and weathertight neoprene bearing surface.
 - 2. Coordinate size and load carrying capacity of roof curb with fans supported by curb.
 - 3. Design and fabricate curbs to carry, within conventional design limits, weight of fan plus snow load, taking into account eccentric loadings or additional wind pressure loads.
 - 4. Wind load pressures: As stated in governing codes, but not less than 30 pounds per square foot of fan surface.
 - 5. Where uplift forces are greater than 100 pounds per linear foot of support, furnish means of directly fastening curb to support steel.
 - 6. Furnish curbs with minimum 16 gauge, zinc coated sheet steel in accordance with ASTM A653 with G90 coating, continuous welded seams at corners, and factory applied wood nailer.
 - 7. Furnish heavier gauge material and internal stiffeners when load conditions require.
 - 8. Internal insulation: 3 pound density rigid fiberglass.
 - 9. Wood nailers: Lumber impregnated with waterborne decay retardant treatment in accordance with AWWA U1 Use Category UC3A.
 - 10. Acceptable manufacturers.
 - a. Pate.
 - b. Roof Product Systems.
 - c. Thybar.
 - d. Uni-Curb.
 - e. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Prefabricated Roof Curbs.
 - 1. Coordinate delivery to jobsite and locate curbs on roof.

2. Installation of curbs is specified under Division 07.
 3. When direct fastening to support steel is required, install fastening devices before mounting fans on curb.
 4. Request details of metal deck and support steel.
 5. Cut openings in roof deck, within curbs.
- B. General Fan Installation Requirements.
1. Install and start up fans as recommended by fan manufacturer.
 2. Maintain fan's operation during test and balance work specified in Section 23 0593.
 3. Make drive adjustments or replace drive components necessary to attain scheduled airflow rates.
 4. Fill lubricating lines of fans with bearing grease.
 5. Owner's first application of lubricant shall result in immediate delivery of grease to bearings.
 6. Motor starters, control stations, and power wiring are specified under Division 26.
- C. Belt Guard.
1. Fasten guards to equipment housing or vibration isolator mountings or, where applicable, mount to floor.
 2. Do not attach belt guard to both fan and to equipment room floor.

3.02 FIELD QUALITY CONTROL

- A. Inspect and Confirm.
1. V-belt drive and belt tension comply with manufacturer's recommendations.
 2. Multiple-belt power transmission drives, belts manufactured by single source, designed for compatible use (corresponding material, size, length, and shape match), and aligned and parallel.
 3. Tachometer access opening in belt guard aligns with shaft ends.
- B. Remove belts with unmatched properties from set of multiple-belt drive, discard unmatched belts, and mount belts with matching physical properties.
- C. Adjust.
1. Belts in multiple-belt drive, aligned and parallel.
 2. Align tachometer access opening in belt guard with shaft.
- D. Within sight of belt drives, affix label containing information needed to purchase replacement belts.

END OF SECTION

SECTION 23 8127
SMALL SPLIT-SYSTEM HEATING AND COOLING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air-source heat pumps.
- B. Air cooled condensing units.
- C. Indoor air handler (fan & coil) units for duct connection.
- D. Controls.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Mounting pad for outdoor unit.
- B. Section 23 3100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

- A. AHRI 210/240 - Standard for Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2008.
- B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; Air-Conditioning, Heating, and Refrigeration Institute; 2004.
- C. ASHRAE Std 23.1 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2010.
- D. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2007.
- E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.
- F. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2012.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- D. Design Data: Indicate refrigerant pipe sizing.
- E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- F. Project Record Documents: Record actual locations of components and connections.
- G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- H. Warranty: Submit manufacturers' warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Filters: One for each unit.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Carrier Corporation: www.carrier.com.
- B. Trane Inc; Model TWA: www.trane.com.
- C. York International Corporation / Johnson Controls: www.york.com.

2.02 SYSTEM DESIGN

- A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
 - 1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; auxiliary electric heat.
 - 2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
- B. Performance Requirements: See Drawings for additional requirements.
 - 1. Efficiency:
 - a. Energy Efficiency Ratio: 11.
 - b. Coefficient of Performance (COP): 3.30.
 - 2. Air Handling:
 - a. Air Flow: 3200 cfm.

2.03 INDOOR UNITS FOR DUCTED SYSTEMS

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
 - 1. Air Flow Configuration: Upflow.
 - 2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
- B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
 - 1. Motor: NEMA MG 1; 1750 rpm single speed, permanently lubricated, hinge mounted.
 - 2. Motor Electrical Characteristics:
- C. Air Filters: 1 inch thick urethane, washable type arranged for easy replacement.
- D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
 - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL listed.
 - 2. Manufacturers: System manufacturer.

2.04 OUTDOOR UNITS

- A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
 - 1. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL listed.
- B. Air Cooled Condenser: ARI 520; Aluminum fin and copper tube coil, with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
- C. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).
 - 1. Provide thermostatic expansion valves.
- D. Operating Controls:
 - 1. Control by room thermostat to maintain room temperature setting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and in correct location.
- C. Verify that proper fuel supply is available for connection.

3.02 INSTALLATION

- A. Install in accordance with NFPA 90A and NFPA 90B.

END OF SECTION

SECTION 26 0130
ACCEPTANCE TESTING - SHORT FORM

PART 1 GENERAL

1.01 GENERAL SCOPE

- A. Engage services of recognized independent testing firm for purpose of performing inspections and tests.
- B. Testing firm shall provide material, equipment, labor, and technical supervision to perform tests and inspections.
- C. Tests and inspections shall determine suitability for energization.

1.02 REFERENCE STANDARDS

- A. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; 2011.
- B. NFPA 70 - National Electrical Code; 2008.

1.03 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. Test Reports.
 - 1. Include.
 - a. Summary of project.
 - b. Description of equipment tested.
 - c. Description of test.
 - d. Test results.
 - e. Analysis and recommendations.
 - 2. Furnish copy or copies of complete report to Owner as required in acceptance Contract.

1.04 QUALITY ASSURANCE

- A. Suitability of Test Equipment.
 - 1. Test Equipment: In good mechanical and electrical condition.
 - 2. Selection of metering equipment should be based on knowledge of waveform of variable being measured.
 - a. Digital multimeters may be average or RMS sensing and may include or exclude DC component.
 - b. When variable contains harmonics or DC offset and, in general, any deviation from pure sine wave, average sensing, RMS scaled meters may be misleading.
 - 3. Accuracy of metering in test equipment: Appropriate for test being performed but not in excess of 2 percent of scale used.
 - 4. Waveshape and frequency of test equipment output waveforms: Appropriate for test and tested equipment.
- B. Test Instrument Calibration.
 - 1. Testing firm shall have calibration program which assures that applicable test instruments are maintained within rated accuracy.
 - 2. Accuracy shall be directly traceable to National Institute of Standards and Technology (NIST).
 - 3. Calibrating standard shall be of higher accuracy than that of instrument tested.
- C. Qualifications of Testing Firm.
 - 1. Independent testing organization which can function as unbiased testing authority, professionally independent of manufacturers, suppliers, and installers of equipment or systems evaluated by testing firm.
 - 2. Regularly engaged in testing of electrical equipment devices, installations, and systems.
 - 3. Fully accredited member company of InterNational Electrical Testing Association.

4. On site lead technical person shall be currently certified by InterNational Electrical Testing Association (NETA) or National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.
 5. Utilize technicians who are regularly employed by firm for testing services.
 6. Testing firm shall submit proof of above qualifications prior to starting work.
- D. Division of Responsibility.
1. Contractor or testing firm shall perform routine insulation-resistance, continuity, and rotation tests for distribution and utilization equipment prior to and in addition to tests performed by testing firm specified herein.
 2. Contractor shall/ Owner will supply suitable and stable source of electrical power to each test site.
 - a. Testing firm shall specify specific power requirements.
 3. Contractor shall/ Owner will notify testing firm when equipment becomes available for acceptance test.
 - a. Work shall be coordinated to expedite project scheduling.
 4. Testing firm shall notify Owner's representative prior to commencement of testing.
 5. Any system, material, or workmanship which is found defective on basis of acceptance tests shall be reported.
 6. Testing firm shall maintain written record of tests and shall assemble and certify final test report.
 7. Safety and precautions.
 - a. Safety practices should include, but are not limited to, following requirements.
 - 1) Occupational Safety and Health Act.
 - 2) Accident Prevention Manual for Industrial Operations, National Safety Council.
 - 3) Applicable state and local safety operating procedures.
 - 4) Owner's safety practices.
 - 5) ANSI/NFPA 70E, Electrical Safety Requirements for Employee Workplaces.
 - 6) American National Standards for Personnel Protection: Lockout/Tagout.
 - b. Perform tests with apparatus de-energized, except where otherwise specifically required.
 - c. Testing organization shall have designated safety representative on project to supervise operations with respect to safety.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 TEST PROCEDURES

- A. Transformers, Dry Type.
1. Air-cooled, 600 volt and below, small (167 kVA single phase, 500 kVA, 3 phase and smaller).
 - a. Perform insulation-resistance test.
 - 1) Calculate polarization index.
 - 2) Measurements shall be made from winding-to-winding and each winding-to-ground.
 - 3) Test voltages and minimum resistance in accordance with NETA Table 100.5.
 - 4) Results to be temperature corrected in accordance with NETA Table 100.14.
 2. Air-cooled, all above 600 volt and 600 volt and below, large (greater than 167 single phase and 500 kVA, 3 phase).
 - a. Electrical tests.
 - 1) Perform insulation-resistance tests winding-to-winding and each winding-to-ground, with test voltage in accordance with NETA Table 100.5.
 - (a) Calculate polarization index.
- B. Transformers, Liquid-Filled.
1. Electrical tests.

- a. Perform insulation-resistance tests, winding-to-winding and each winding-to-ground with test voltage in accordance with NETA Table 100.5.
 - 1) Test duration shall be for 10 minutes with resistances tabulated at 30 seconds, one minute, and 10 minutes.
 - 2) Calculate polarization index.
 - b. Perform turns-ratio test on no-load tap-changer positions and load tap-changer positions.
 - 1) Verify that tap setting is as specified.
 - 2) Verify that winding polarities are in accordance with nameplate.
 - c. Perform insulation power-factor/dissipation-factor tests on windings and correct to 20 degrees C in accordance with test equipment manufacturer's instructions.
 - 1) Perform power-factor/dissipation-factor tests (or hot collar watts-loss tests) on bushings and correct for 20 degrees C in accordance with test equipment manufacturer's instructions.
 - d. If core ground strap is accessible, measure core insulation resistance at 500 volts DC.
 - e. Measure percentage of oxygen in nitrogen gas blanket.
 - 1) Remove sample of insulating liquid in accordance with ASTM D923.
 - 2) Test sample for following.
 - (a) Dielectric breakdown voltage, ASTM D877 and/or ASTM D1816.
 - (b) Acid neutralization number, ASTM D974.
 - (c) Interfacial tension, ASTM D971 or ASTM D2285.
 - (d) Color, ASTM D1500.
 - (e) Visual condition, ASTM D1524.
 - 3) Measure dissipation factor or power factor in accordance with ASTM D924.
 - f. Remove sample of insulating liquid in accordance with ASTM D3612 and perform dissolved gas analysis (DGA) in accordance with ANSI/IEEE C57.104 or ASTM D3612.
- C. Cables, Low-Voltage, 600 Volts Maximum.
1. Electrical tests.
 - a. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors.
 - 1) Applied potential to be 1000 volts DC for one minute.
 - b. Perform continuity test to ensure correct cable connection.
- D. Cables, medium-voltage, 69 kV maximum.
1. Electrical tests.
 - a. Perform shield-continuity test on each power cable by ohmmeter method.
 - b. Perform insulation-resistance test utilizing megohmmeter with voltage output of at least 2500 volts.
 - 1) Individually test each conductor with other conductors and shields grounded.
 - 2) Test duration: One minute.
 - c. Perform DC high-potential test on cables.
 - 1) Adhere to precautions and limits as specified in applicable NEMA/ICEA Standard for specific cable.
 - 2) Perform tests in accordance with ANSI/IEEE Standard 400.
 - 3) Test procedure as follows, and record results for each cable test as specified herein.
 - 4) Test voltages: Not exceed 80 percent of cable manufacturer's factory test value or maximum test voltage in NETA Table 100.6.
 - (a) Ensure that input voltage to test set is regulated.
 - (b) Current-sensing circuits in test equipment shall measure only leakage current associated with cable under test and shall not include internal leakage of test equipment.

- (c) Record wet- and dry-bulb temperatures or relative humidity and temperature.
- (d) Test each section of cable individually.
- (e) Individually test each conductor with other conductors grounded, and ground shields.
- (f) Terminations shall be adequately corona-suppressed by guard ring, field reduction sphere, or other suitable methods as necessary.
- (g) Ensure that maximum test voltage does not exceed limits for terminators specified in IEEE Standard 48 or manufacturer's specifications.
- (h) Apply DC high-potential test in at least eight equal increments until maximum test voltage is reached.
 - (1) No increment shall exceed voltage rating of cable.
 - (2) Record DC leakage current at each step after constant stabilization time consistent with system charging current.
 - (3) Raise conductor to specified maximum test voltage and hold for five minutes.
 - (4) Record readings of leakage current at 15 second intervals for first two minutes and at one minute intervals thereafter.
 - (5) Reduce conductor test potential to zero and measure residual voltage at discrete intervals.
 - (6) Apply grounds for time period adequate to drain insulation stored charge.
 - (7) When new cables are spliced into existing cables, perform DC high-potential test on new cable prior to splicing in accordance with subheading, Cables, item titled, Liquid-filled.
 - (8) After test results are approved for new cable and splice is completed, perform insulation-resistance test and shield-continuity test on length of new and existing cable including splice.
 - (9) After satisfactory insulation-resistance test, perform DC high-potential test on cable utilizing test voltage acceptable to Owner and not exceeding 60 percent of factory test value.

E. Circuit Breakers, Low-Voltage, Insulated Case/Molded Case.

- 1. Electrical tests.
 - a. Perform contact-resistance test.
 - b. Perform insulation-resistance test at 1000 volts DC from pole-to-pole and from each pole-to-ground with breaker closed and across open contacts of each phase.
 - c. Perform adjustments for final settings in accordance with coordination study supplied by Owner.
 - d. Perform long-time delay time-current characteristic tests by passing 300 percent rated current through each pole separately unless series testing is required to defeat ground fault functions.
 - e. Determine short-time pickup and delay by primary current injection.
 - f. Determine ground-fault pickup and time delay by primary current injection.
 - g. Determine instantaneous pickup current by primary injection using run-up or pulse method.
 - h. Verify correct operation of auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, and antipump function.

F. Circuit Breakers, Medium-Voltage, Air.

- 1. Electrical tests.
 - a. Measure contact resistance.
 - b. Measure insulation resistance pole-to-pole, pole-to-ground, and across open poles.
 - 1) Use minimum test voltage of 2500 volts.
 - c. With breaker in test position, make following tests.
 - 1) Trip and close breaker with control switch.

- 2) Trip breaker by operating each of its protective relays.
 - 3) Verify trip-free and antipump function.
 - d. Perform dissipation-factor/power-factor test with breaker in both open and closed position.
 - e. Perform overpotential test in accordance with manufacturer's published data.
- G. Grounding Systems.
- 1. Electrical tests.
 - a. Where foundation resteel is bonded to steel columns, consider entire foundation as ground electrode.
 - b. Perform fall-of-potential test in accordance with IEEE Standard 81-1991 on each grounding electrode.
 - c. After entire building ground grid as been interconnected, test entire grid system, not exceeding 5 ohms to ground.
 - 1) Test procedure, Intersecting Curves Method, in accordance with IEE (British) Proceedings Volume 116, March 1969, Dr. G. Tagg, or Slope Method, IEE (British) Proceedings Volume 117, November 1970, Dr. G. Tagg.
 - d. Perform point-to-point tests to determine resistance between main grounding system and major electrical equipment frames, system neutral, and/or derived neutral points.
- H. Ground-Fault Protection Systems.
- 1. Electrical tests.
 - a. Measure system neutral-to-ground insulation resistance with neutral disconnect link temporarily removed.
 - 1) Replace neutral disconnect link after testing.
 - b. Perform following pickup tests using primary injection.
 - 1) Verify that relay does not operate at 90 percent of pickup setting.
 - 2) Verify pickup is less than 125 percent of setting or 1200 amperes, whichever is smaller.
 - c. For summation type systems utilizing phase and neutral current transformers, verify correct polarities by applying current to each phase-neutral current transformer pair.
 - 1) This test also applies to molded-case breakers utilizing external neutral current transformer.
 - (a) Relay should operate when current direction is same relative to polarity marks in two current transformers.
 - (b) Relay should not operate when current direction is opposite relative to polarity marks in two current transformers.
 - d. Measure time delay of relay at 150 percent or greater of pickup.
 - e. Verify reduced control voltage tripping capability.
 - 1) 55 percent for AC systems.
 - 2) 80 percent for DC systems.
 - f. Verify blocking capability of zone interlock systems.
- I. Rotating Machinery, AC Motors.
- 1. Electrical tests, induction motors.
 - a. Perform insulation-resistance tests in accordance with ANSI/IEEE Standard 43.
 - 1) Motors larger than 200 hp.
 - (a) Test duration: 10 minutes.
 - (b) Calculate polarization index.
 - 2) Motors 200 hp and less.
 - (a) Test duration: One minute.
 - (b) Calculate dielectric-absorption ratio.
 - b. Perform DC overpotential tests on motors rated at 1000 hp and greater and at 4000 volts and greater in accordance with ANSI/IEEE Standard 95.
 - c. Perform insulation-resistance test on pedestal in accordance with manufacturer's published data.

- d. Test surge protection devices in accordance with subheading, Surge Arresters, of these Specifications.
 - e. Test motor starter in accordance with subheading, Motor Control, of these Specifications.
 - f. Verify that resistance temperature detector (RTD) circuits conform to drawings.
 - 1) Verify that metering or relaying devices using RTD's have correct rating.
 - g. Verify that motor space heater is functional.
 - h. Perform rotation test to ensure correct shaft direction.
 - i. Measure running current and evaluate relative to load conditions and nameplate full-load amperes.
 - j. Perform vibration tests.
 - 1) Motors larger than 200 hp.
 - (a) Perform vibration baseline test.
 - (b) Plot amplitude versus frequency.
 - 2) Motors 200 hp and less.
 - (a) Perform vibration amplitude test.
2. Electrical tests, synchronous motors.
- a. Perform tests as indicated in subheading, Rotating Machinery, DC Motors, for induction motors.
 - b. Perform insulation-resistance tests on main rotating field winding, exciter-field winding, and exciter-armature winding in accordance with ANSI/IEEE Standard 43.
 - c. Perform high-potential test on excitation system in accordance with ANSI/IEEE Standard 421B.
 - d. Measure and record resistance of motor field winding, exciter-stator winding, exciter-rotor windings, and field discharge resistors.
 - e. Prior to initial start, apply voltage to exciter supply and adjust exciter-field current to nameplate value.
 - f. Verify that field application timer and enable timer for power-factor relay have been tested and set to motor drive manufacturer's recommended values.
 - g. Plot V-curve of stator current versus excitation current at approximately 50 percent load to check correct exciter operation.
 - h. If range of exciter adjustment and motor loading permit reduce excitation to cause power factor to fall below trip value of power-factor relay.
 - 1) Verify relay operation.
- J. Motor Control, Motor Starters, Low-Voltage.
1. Electrical tests.
- a. Insulation tests.
 - 1) Measure insulation resistance of each combination starter, phase-to-phase and phase-to-ground, with starter contacts closed and protective device open.
 - 2) Test voltage in accordance with NETA Table 100.1.
 - 3) Refer to manufacturer's instructions for devices with solid-state components.
 - b. Test circuit breakers in accordance with subheading, Circuit breakers, sub-subheading, Low-voltage, item titled, Insulated case/molded case.
 - c. Perform operational tests by initiating control devices.
- K. Surge Arresters, Low-Voltage Surge Protection Devices.
1. Electrical tests.
- a. Perform insulation-resistance tests.
 - b. Use manufacturer's recommended values or NETA Table 100.1.
2. Test values.
- a. Bolt-torque levels in accordance with NETA Table 100.12 unless otherwise specified by manufacturer.
 - b. Insulation-resistance values in accordance with NETA Table 100.1.
- L. Control Cables.

1. Check single conductor and multiconductor control cables for continuity and identification.
 2. Station person at each termination point of control cable tested.
 3. Fan wires out, accessible for tests.
 4. Check continuity and identification by means of DC test device using bell or buzzer.
 5. Use phones only for communications between testers.
 6. Control cable containing shorted or grounded conductors, indicated by test, is unacceptable.
- M. Control Devices.
1. Perform operating tests on control, alarm, or indicating devices installed under Division 26.
 2. Include motors and protective control devices in test circuitry if operation of motors does not damage attached equipment.
 3. Where equipment could be damaged by energizing motors, disconnect motor leads at load side of starters.
 4. Disconnect, or bypass with jumper, control devices not specified under Division 26 to allow testing in this section.
 5. Coordinate these connections and tests with Contractor responsible for installation of motors.
 6. Make complete records of tests.

END OF SECTION

SECTION 26 0513
MEDIUM-VOLTAGE CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Medium voltage cable.
- B. Cable terminations.

1.02 RELATED REQUIREMENTS

- A. Section 26 0130 - Acceptance Testing.
- B. Section 26 0553 - Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. AEIC CS8 - Specifications for Extruded Dielectric, Shielded Power Cables Rated 5 through 46 kV; 2007.
- B. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2012.
- C. ASTM B496 - Specification for Compact Round Concentric-Lay Stranded Copper Conductors; 2004e1.
- D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³); 2012.
- E. ICEA S-94-649 - Standard for Concentric Neutral Cables Rated 5,000 - 46,000 Volts; 2004.
- F. IEEE C2 - National Electrical Safety Code; Institute of Electrical and Electronic Engineers; 2012.
- G. IEEE 48 - IEEE Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV; Institute of Electrical and Electronic Engineers; 1996 (R2009).
- H. IEEE 404 - IEEE Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 to 500000 V; 2012.
- I. NEMA WC 70 - Nonshielded Power Cable 2000 V or Less for the Distribution of Electrical Energy; National Electrical Manufacturers Association; 2009.
- J. NEMA WC 74 - S5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy; National Electrical Manufacturers Association; 2012.
- K. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).
- L. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- M. UL (ECMD) - Electrical Construction Materials Directory; current edition.
- N. UL 1072 - Medium Voltage Power Cables; 2011 (2012).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide for cable, terminations, and accessories.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Project Record Documents: Record actual sizes and locations of cables.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.01 CABLE

- A. Primary feeder designed and sized by Stewart Engineering.
- B. Primary feeder shall be furnished and installed by Electrical Contractor.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that raceway systems are complete, dry and weather protected.
- B. Verify that field measurements are as indicated.
- C. Verify routing and termination locations of cable bank prior to rough-in.

3.02 PREPARATION

- A. Use swab to clean conduits and ducts before pulling cables.

3.03 INSTALLATION

- A. Avoid abrasion and other damage to cables during installation.
- B. Install cable in raceway systems, except where exposed or direct burial is specified in the Contract Documents.
- C. Use suitable lubricants and pulling equipment.
- D. Sustain cable pulling tensions and bending radii below recommended limits.
- E. When cables are pulled using powered winch, do not exceed tension limits recommended by the cable manufacturer.
- F. If, in opinion of Owner's Field Representative, tension limits are being exceeded, use dynamometer on remaining pulls.
- G. Ground cable shield at each termination and splice.
- H. Connect power wiring to equipment for phasing A-B-C-N left to right, top to bottom, and front to back, where possible, and permanently identify phasing on the structure or housing adjacent to connection.
- I. Phase identification A-B-C is equivalent to transformer phase identification X1-X2-X3 and H1-H2-H3.
- J. In Underground Duct.
 - 1. Brush and swab ducts before pulling cable.
 - 2. Use flexible cable feeders of appropriate size to lead cable from reel into duct mouth.
 - 3. In manholes and handholes, install power cables on cable racks along wall providing longest route.
 - 4. When passing cables through manholes and handholes, avoid crossovers so each cable is accessible when placed on racks. Arrange cables to avoid interference with duct entrances.
 - 5. Install cables in ducts in same relative position throughout underground system, unless otherwise required or indicated.
 - 6. Keep spare ducts accessible for future use.
 - 7. Fireproof cables in manholes using fireproofing tape in half-lapped wrapping. Extend fireproofing 1 inch into duct.
- K. Cable Terminations.
 - 1. Terminate conductors with lugs corresponding to specific size and type of conductor.
 - 2. Do not open cable prior to terminating.
 - 3. Executing cable termination in damp or inclement weather environment is unacceptable, except under temporary protective structure.
 - 4. Once cable is opened, immediately commence execution of termination and continue work until termination, including sealing work, is completed.
 - 5. Thoroughly clean wire ends before connectors are applied.

6. Before installing a compression lug on an aluminum conductor, apply an aluminum joint compound to exposed conductor and wire brush through compound to remove aluminum oxide.
7. Install lug immediately after wire brushing conductor.
8. Insulate terminations with materials in packaged field terminating kit.
9. Follow manufacturer's instructions.
10. Include rain shields on outdoor taped terminations.
11. To terminate copper lugs on aluminum bus, use Belleville washer and 2 tin or cadmium plated washers, one on either side in combination with aluminum joint compound on contacting surfaces. Tighten bolts until Belleville washer is flat.
12. Use armor cable terminators for armored cable terminations at equipment.
13. Terminate cable ground conductors on equipment ground bus.

3.04 FIELD QUALITY CONTROL

- A. Perform acceptance testing as specified in Section 26 0130.

3.05 PROTECTION

- A. Protect installed cables from entrance of moisture.

END OF SECTION

SECTION 26 0519
BUILDING WIRE AND CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Wiring connectors.
- D. Electrical tape.
- E. Heat shrink tubing.
- F. Wire pulling lubricant.

1.02 RELATED REQUIREMENTS

- A. Section 07 8413 - Through-Penetration Firestop Systems.
- B. Section 26 0130 - Acceptance Testing.
- C. Section 26 0513 - Medium-Voltage Cable: Cables and terminations for systems 601 V through 35,000 V.
- D. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- E. Section 26 0543 - Underground Ducts and Raceways for Electrical Systems.
- F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 28 3100 - Fire Detection and Alarm: Fire alarm system conductors and cables.

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2012.
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010.
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2009).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.
- F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2008.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- H. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); National Electrical Contractors Association; 2006.
- I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; National Electrical Manufacturers Association; 2009 (ANSI/NEMA WC 70/ICEA S-95-658).
- J. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).
- K. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- L. NFPA 99 - Standard for Health Care Facilities; 2009.
- M. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

- N. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- O. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- P. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- Q. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- R. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- S. UL (ECMD) - Electrical Construction Materials Directory; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with conductors to be installed.
 - 3. Notify Architect-Engineer of any conflicts with or deviations from contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. Submittals: Not Required.
- B. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- D. Manufactured Wiring System Shop Drawings: Provide plan views indicating proposed system layout with components identified; indicate branch circuit connections.
- E. Product Data:
 - 1. Select each length to include complete set of manufacturer markings.
 - 2. Attach tag indicating cable size and application information.
- F. Field Quality Control Test Reports.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency.
- H. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.
- C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect-Engineer and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Metal-clad cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
 - 1) Maximum Length: 6 feet.
- D. Concealed Dry Interior Locations: Use only building wire in raceway.
- E. Exposed Dry Interior Locations: Use only building wire in raceway.
- F. Above Accessible Ceilings: Use only building wire in raceway or metal clad cable.
- G. Wet or Damp Interior Locations: Use only building wire in raceway.
- H. Exterior Locations: Use only building wire in raceway, direct burial cable, or service-entrance cable.
- I. Underground Installations: Use only service-entrance cable.
- J. Use single conductor unless multiconductor is indicated on drawings.
- K. Use stranded conductors for 8 AWG and larger.
- L. Use stranded conductors for control circuits.
- M. Use conductor not smaller than 12 AWG for power and lighting circuits.
- N. Use conductor not smaller than 16 AWG for control circuits.
- O. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
- P. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.
- Q. Conductor sizes are based on copper unless indicated as aluminum or "AL".

2.02 CONDUCTOR AND CABLE MANUFACTURERS

- A. Aetna Insulated Wire Company.
- B. AFC Cable Systems.
- C. American Insulated Wire Corporation.
- D. General Cable
- E. Houston Wire and Cable Company.
- F. The Okonite Company.
- G. Prysmian Power Cables and Systems (Pirelli Cable Corporation) www.us.prysmian.com.
- H. Service Wire Company.
- I. Southwire Company.
- J. Substitutions: See Section 01 6000 - Product Requirements.

2.03 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for purpose indicated.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.

- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.
- H. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.
- I. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
- J. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
 - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
 - 2. Control Circuits: 14 AWG.
- K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- L. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 - 3. Color Code:
 - a. 480Y/277 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral/Grounded: Gray.
 - b. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - c. Equipment Ground, All Systems: Green.
 - d. Travelers for 3-Way and 4-Way Switching: Pink.

2.04 SINGLE CONDUCTOR BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.
- D. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN, THHN/THWN-2, or THHW, except as indicated below.

- a. Installed Underground: Type XHHW-2.
- b. Service Entrance: Type XHHW-2.
- E. Conductor: Copper.

2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 0526.
- C. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
 - 1. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
 - 2. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
 - 3. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
 - 1. Manufacturers:
 - a. 3M: www.3m.com.
 - b. Ideal Industries, Inc: www.idealindustries.com.
 - c. NSI Industries LLC: www.nsiindustries.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- F. Mechanical Connectors: Provide bolted type.
 - 1. Manufacturers:
 - a. Burndy: www.burndy.com.
 - b. IlSCO: www.ilsco.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- G. Compression Connectors: Provide circumferential type or hex type crimp configuration.
 - 1. Manufacturers:
 - a. Burndy: www.burndy.com.
 - b. IlSCO: www.ilsco.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- H. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
 - 1. Manufacturers:
 - a. Burndy: www.burndy.com.
 - b. IlSCO: www.ilsco.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.06 WIRING ACCESSORIES

- A. Electrical Tape:
 - 1. Manufacturers:
 - a. 3M: www.3m.com.
 - b. Plymouth Rubber Europa: www.plymouthrubber.com.

- c. Substitutions: See Section 01 6000 - Product Requirements.
- 2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
- 3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
- 4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
- 5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
- C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
- D. Spring Wire Connectors.
 - 1. For conductors 10 AWG and smaller.
 - 2. Product: Scotchlock by 3M.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- E. Compression Connectors.
 - 1. For conductors 6 AWG and larger.
 - 2. Acceptable manufacturers.
 - a. FCI-Burndy.
 - b. Ideal Electric Corporation.
 - c. IlSCO.
 - d. Thomas and Betts.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- F. Lugs for Terminating Conductors.
 - 1. For 8 AWG and smaller.
 - a. Material: Copper.
 - b. Solderless type.
 - c. Equipment manufacturer's standard, unless noted otherwise.
 - 2. For 6 AWG and larger.
 - a. Material: Copper.
 - b. Solderless compression type.
 - c. One-hole for 6 AWG through 4/0 AWG inclusive.
 - d. Two-hole for larger sizes.
 - e. Acceptable manufacturers.
 - 1) FCI-Burndy.
 - 2) IlSCO.
 - 3) Thomas and Betts Corporation.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
 - 3. For control and switchboard wiring.
 - a. Solderless compression type with tinned ring tongue.
 - b. Acceptable products.
 - 1) Hydent by FCI-Burndy.
 - 2) Sta-Kon by Thomas and Betts.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.07 LUBRICATING COMPOUND

- A. Acceptable Manufacturers.

1. American Polywater Corporation.
2. Greenlee Textron.
3. Ideal Industries Incorporated.
4. Thomas and Betts.
5. 3M.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.08 INSULATING TAPE

A. Acceptable Products.

1. For general use: 33 Plus by 3M Company.
2. For high temperature use: 27 by 3M Company.

B. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that raceway installation is complete and supported.
- E. Verify that field measurements are as shown on the drawings.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 2. When circuit destination is indicated and routing is not shown, determine exact routing required.
 3. Arrange circuiting to minimize splices.
 4. Include circuit lengths required to install connected devices within 10 ft of location shown.
 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is not permitted.
 - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
 7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
 - a. Branch circuits fed from ground fault circuit interrupter (GFCI) circuit breakers.
 - b. Branch circuits fed from feed-through protection of GFI receptacles.
 - c. Branch circuits with dimming controls.
- B. Install products in accordance with manufacturer's instructions.
- C. Install conductors and cable securely in a neat and workmanlike manner in accordance with NECA 1.
- D. Install metal-clad cable (Type MC) in accordance with NECA 120.
- E. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- H. Install conductors with a minimum of 12 inches of slack at each outlet.
- I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- J. Make wiring connections using specified wiring connectors.
1. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 2. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 3. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 4. Do not remove conductor strands to facilitate insertion into connector.
 5. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- K. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
- L. Insulate ends of spare conductors using vinyl insulating electrical tape.
- M. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- N. Identify conductors and cables in accordance with Section 26 0553. Identify each conductor with its circuit number or other designation indicated.
- O. Provide wire and cable markers in accordance with Section 26 0553 identifying circuit number or other designation indicated at the following locations:
1. At each source and load connection.
 2. Within boxes when more than one circuit is present.

- 3. Within equipment enclosures when conductors and cables enter or leave the enclosure.
- 4. In cable tray, at maximum intervals of 20 feet.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.
- R. Install in raceway, except where exposed wiring is indicated or specified.
- S. Use wiring methods indicated.
- T. Install conductors so bending radius is not less than minimum recommended by ICEA or manufacturer.
- U. Install conductors continuous, without splices between devices.
- V. Where splices are required, use splice boxes, do not use fittings for splices.
- W. To terminate copper lugs on aluminum bus, use Belleville washer and two tin or cadmium plated washers, one on either side in combination with aluminum joint compound on contacting surfaces. Tighten bolts until Belleville washer is flat.
- X. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- Y. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- Z. Insulate bare surfaces of conductors with four layers (half lap in two directions) of electrical insulating tape.
- AA. Connect power wiring to equipment for phasing A-B-C-N left to right, top to bottom, and front to back, where possible, and permanently identify phasing on structure or housing adjacent to connection.
- AB. Phase identification A-B-C is equivalent to transformer phase identification X1-X2-X3 and H1-H2-H3.

3.04 FIELD QUALITY CONTROL

- A. Perform acceptance testing as specified in Section 26 0130.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.3.2. Insulation resistance test is required for all conductors. Resistance test for parallel conductors listed as optional is not required.
- D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.
- F. Grounding and Bonding Components.
- G. Provide all components necessary to complete grounding system(s) consisting of.
 - 1. Metal frame of building.
 - 2. Concrete-encased electrode.
 - 3. Rod electrodes.
- H. Electrical systems grounding and bonding.
- I. Telecommunications systems grounding and bonding.

1.02 RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 26 5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS

- A. IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System; 1983.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; National Electrical Manufacturers Association; 2007.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- E. UL(ECMD) - Electrical Construction Materials Directory; current edition.
- F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Notify Architect-Engineer of any conflicts with or deviations from contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Field quality control test reports.
- E. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect-Engineer. Precipitation within previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
 - 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested according to IEEE 81 using "point-to-point" methods.
- E. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at accessible location not more than 5 feet from point of entrance to building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
 - 3. Metal Building or Structure Frame:
 - a. Provide connection to metal building or structure frame effectively grounded in accordance with NFPA 70 at nearest accessible location.
 - 4. Ground Rod Electrode(s):

- a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
 - b. Space electrodes not less than 10 feet from each other and any other ground electrode.
 - c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
5. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
6. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
 - a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
 - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
 - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- F. Service-Supplied System Grounding:
 1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- G. Separately Derived System Grounding:
 1. Separately derived systems include, but are not limited to:
 - a. Transformers (except autotransformers such as buck-boost transformers).
 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in area served by derived system, where not already used as grounding electrode for derived system. Make connection at same location as grounding electrode conductor connection.
 4. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
 5. Where source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- H. Bonding and Equipment Grounding:
 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
 7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.
 8. Provide bonding for metal building frame where not used as grounding electrode.
- I. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
 2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
 - b. Raceway Size: 3/4 inch unless otherwise indicated or required.
 - c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
 - d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- J. Pole-Mounted Luminaires: Also comply with Section 26 5600.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for purpose indicated.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in addition to requirements of Section 26 0519:
1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
 2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.
 3. Flexible Braid.
 - a. Electro tin-plated copper braids.
 - b. Seamless pure copper ferrules.
 - c. Bolted connections.
 - d. Manufacturers.
 - 1) IlSCO.
 - 2) O. Z. Gedney.
 - 3) Thomas & Betts.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for application and suitable for conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 3. Unless otherwise indicated, use exothermic welded connections for accessible connections.

4. Fittings for Connecting to Water Pipes.
 - a. Product: GD or GG manufactured by Burndy or Series 2818 10 3821, 3824 and 3890 manufactured by Thomas & Betts.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
 5. Fittings for Bonding Grounding Conductor to Fence.
 - a. Product: Type GL or GD manufactured by Burndy.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
 6. Manufacturers - Mechanical and Compression Connectors:
 - a. Blackburn/Holub, Div. Thomas & Betts.
 - b. Burndy: www.burndy.com.
 - c. IlSCO.
 - d. O. Z. Gedney.
 - e. Thomas & Betts Corporation: www.tnb.com.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
 7. Manufacturers - Exothermic Welded Connections:
 - a. Burndy: www.burndy.com.
 - b. Cadweld, a brand of Erico International Corporation: www.erico.com.
 - c. ThermOweld, a brand of Continental Industries, Inc.: www.thermoweld.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.
 3. Holes for Connections: As indicated or as required for connections to be made.
 4. Manufacturers:
 - a. Erico International Corporation: www.erico.com.
 - b. ThermOweld, a brand of Continental Industries, Inc.: www.thermoweld.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
 2. Material: Copper-bonded (copper-clad) steel.
 3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
 4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
 5. Manufacturers:
 - a. Blackburn/Holub, Div. Thomas & Betts.
 - b. Erico International Corporation: www.erico.com.
 - c. Galvan Industries, Inc.: www.galvanelectrical.com.
 - d. Harger Lightning & Grounding: www.harger.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as shown on the drawings.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 GROUNDING CONDUCTOR REQUIREMENTS

- A. General use above and below grade: Bare or Insulated.
- B. Underground ducts in duct banks: Bare.
- C. In conduit with phase conductors: insulated.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install grounding and bonding system components in neat and workmanlike manner in accordance with NECA 1.
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
- D. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 26 0553.
- F. Install ground electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
- G. Install 2/0 AWG bare copper wire in foundation footing where indicated.
- H. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.
- I. Connections to ground electrodes and structural steel building framing: Exothermic type.
- J. Connections to nonpermanently fixed equipment: Mechanical lugs.
- K. Make ground connections to structural steel building framing exposed in web of columns.
- L. Bond ground conductor to conduit at each end of metallic conduit used for mechanical protection of ground conductor.
- M. Install telecommunications grounding system as indicated in the Contract Documents..
 - 1. See TIA-607 for sizing of materials for telecommunications grounding.
 - 2. Telecommunications Main Grounding Busbar (TMGB).
 - a. Mount in Telecommunications Entrance Facility Room.
 - b. Mount near telephone terminal board, if present.
 - c. Mount on insulated stand offs with screw terminals 2 inches minimum from wall and 18 inches minimum above finished floor.
 - d. Bond to structural steel building framing with minimum 6 AWG conductor where vertical framing is readily available in room.
 - 3. Primary Protector Grounding Conductor.
 - a. Install continuous from building service equipment (power) ground to TMGB.
 - b. Intended to conduct lightning and fault currents from the telecommunications primary protectors.
 - 4. Telecommunications Grounding Bar (TGB).
 - a. Install in each Telecommunications Room (TR).
 - b. Bond to structural steel building framing with minimum 6 AWG conductor where vertical framing is readily available in room.
 - 5. Telecommunications Bonding Backbone (TBB).
 - a. Install continuous to all telecommunications rooms.

- 6. Do not use water piping or cable shields as TBB.
- 7. Install telecommunications Grounding Equalizers (GE) as required.
- 8. Label and mark with green color telecommunications grounding conductors.
- N. Provide separate green ground conductor in branch circuits serving receptacles, equipment and wall mounted lighting fixtures in patient care areas in accordance with NFPA 70.
- O. Provide 6 AWG bonding conductor between ground buses in normal and emergency panels serving the same area.

3.04 FIELD QUALITY CONTROL

- A. Perform acceptance testing as specified in Section 26 0130.
- B. Perform ground electrode resistance tests under normally dry conditions. Precipitation within previous 48 hours does not constitute normally dry conditions.
- C. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

- A. Section 01 4100 - Regulatory Requirements - Seismic Control.
- B. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- C. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.
- D. Section 26 0534 - Conduit: Additional support and attachment requirements for conduits.
- E. Section 26 0537 - Boxes: Additional support and attachment requirements for boxes.
- F. Section 26 2501 - Low-Voltage Busways: Additional support and attachment requirements for busway.
- G. Section 26 3100 - Photovoltaic Collectors: Photovoltaic module mounting systems.
- H. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- I. Section 26 5113 - Luminaires, Ballasts, and Drivers - Lutron: Additional support and attachment requirements for luminaires.
- J. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2012.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- D. ASTM A325; Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2009.
- E. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2013.
- F. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2012.
- G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2012.
- H. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2012.
- I. MFMA-4 - Metal Framing Standards Publication; Metal Framing Manufacturers Association; 2004.
- J. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- K. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); National Electrical Contractors Association; 2013.
- L. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

- N. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
 2. Coordinate work with other trades to provide additional framing and materials required for installation.
 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 5. Notify Architect-Engineer of any conflicts with or deviations from contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.
- E. Installer's Qualifications: Include evidence of compliance with specified requirements.
- F. Certificate: Certify that products of this section meet or exceed specified requirements.
- G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum ten (10) years of experience.
- F. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.
- G. Installer Qualifications for Field-Welding: As specified in Section 05 5000.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
 2. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for purpose indicated, where applicable.
 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with a minimum safety factor of 2.0. Include consideration for vibration, equipment operation, and shock loads where applicable.
 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 6. Steel Components: Use corrosion resistant materials suitable for environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 2. Conduit Clamps: Bolted type unless otherwise indicated.
 3. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Cooper Industries: www.cooperindustries.com.
 - b. Erico International Corporation: www.erico.com.
 - c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
 - d. Thomas & Betts Corporation: www.tnb.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- C. Outlet Box Supports: Hangers, brackets, etc. suitable for boxes to be supported.
1. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Cooper Industries: www.cooperindustries.com.
 - b. Erico International Corporation: www.erico.com.
 - c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
 - d. Thomas & Betts Corporation: www.tnb.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.
 2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
 3. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
 4. Minimum Channel Thickness: 12 gauge.
 5. Minimum Channel Dimensions: 1-5/8 inch width by 1-5/8 inch height.
 6. Coatings:
 - a. Metallic Coatings:
 - 1) Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 2) Electro-galvanized in compliance with ASTM B633

- b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - c. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
- 7. Manufacturers:
 - a. Cooper B-Line, a division of Cooper Industries: www.cooperindustries.com.
 - b. ERICO International Corporation: <http://www.erico.com>.
 - c. National Pipe Hanger Corp.: www.nationalpipehanger.com.
 - d. Thomas & Betts Corporation: www.tnb.com.
 - e. Unistrut, a brand of Atkore International Inc.: www.unistrut.com.
 - f. Wesanco, Inc.: www.wesanco.com.
 - g. Substitutions: See Section 01 6000 - Product Requirements.
 - h. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
 - 1. Threaded at both ends, or continuous threaded rods of circular cross section.
 - 2. For diameter sizes of 3/8 inch (10mm) and larger, provide double locknut.
 - 3. Minimum sizes unless otherwise indicated on drawings or required by load and hanger spacing:
 - a. General support and finished spaces, 1/4 inch (6 mm) diameter.
 - b. Equipment Supports: 1/2 inch diameter.
 - c. Busway Supports: 1/2 inch diameter.
 - d. Cable tray Supports: 1/2 inch diameter.
 - e. Industrial Areas: 3/8 inch diameter.
 - f. Single Conduit up to 1 inch (27mm) trade size: 1/4 inch diameter.
 - g. Single Conduit larger than 1 inch (27mm) trade size: 3/8 inch diameter.
 - h. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
 - i. Outlet Boxes: 1/4 inch diameter.
 - j. Luminaires: 1/4 inch diameter.
 - 4. Finish.
 - a. Indoor: Self-colored, oiled finish.
 - b. Outdoor: Hot dipped galvanized.
 - c. In contact with aluminum: Hot dipped galvanized.
- F. Beam Clamps:
 - 1. Comply with.
 - a. UL listed.
 - b. Factory Mutual Approved
 - c. Federal Specification WW-H-171E & A-A-1192A
 - d. Manufacturers Standardization Society ANSI/MSS SP-69 & SP-58.
 - 2. General areas.
 - a. Material: Carbon steel, malleable iron, or forged steel
 - 3. Industrial areas, Utility areas, and above ceilings in finished areas.
 - a. Material: Malleable iron or wrought steel.
 - b. Integral hook rod to grip beam flange.
 - 4. Finish.
 - a. Indoor: Self-colored, oiled finish.
 - b. Outdoor: Hot dipped galvanized.
 - c. In contact with aluminum: Hot dipped galvanized.
- G. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for specified applications.
 - 2. Concrete Structural Elements: Use precast concrete inserts, expansion anchors, screw anchors, or preset inserts.

- a. Wedge type: Complying with ICC-ES-AC193.
 - b. Screw type: Complying with ICC-ES-AC193.
 - c. Adhesive type: Complying with ICC-ES-AC308.
- 3. Concrete Surfaces: self-drilling or expansion anchors.
- 4. Solid or Grout-Filled Masonry: Use expansion anchors, screw anchors, or preset inserts.
 - a. Wedge type: Complying with ICC-ES-AC01.
 - b. Screw type: Complying with ICC-ES-AC106.
- 5. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
- 6. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
- 7. Manufacturers - Mechanical Anchors:
 - a. Cooper B-Line, a division of Cooper Industries: www.cooperindustries.com.
 - b. Empire Tool and Manufacturing Co., Inc.: www.empireindustries.com
 - c. Hilti, Inc.: www.us.hilti.com.
 - d. ITW Red Head, a division of Illinois Tool Works, Inc.: www.itwredhead.com.
 - e. MKT Fastening, LLC.: www.mktfastening.com
 - f. Powers Fasteners, Inc.: www.powers.com.
 - g. Simpson Strong-Tie Company Inc.: www.strongtie.com.
 - h. Substitutions: See Section 01 6000 - Product Requirements.
- H. Steel Spring Clips.
 - 1. For support of manufactured wiring assemblies and single conduits, 3/4 inch maximum.
 - 2. Manufacturers:
 - a. Caddy Fasteners manufactured by Erico International Corporation.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURERS

- A. Atkore International, Inc.; Power-Strut: www.power-strut.com
- B. Cooper (Eaton) B-Line: www.cooperindustries.com.
- C. Erico International Corporation: www.erico.com.
- D. National Pipe Hanger Corp.: www.nationalpipehanger.com.
- E. Thomas & Betts Corporation: www.tnb.com.
- F. All-Ohio Threaded Rod Company: www.allohiorod.com.
- G. Unistrut Corporation: www.unistrut.com.
- H. Wesanco, Inc.: www.wesanco.com.
- I. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install support and attachment components as required to adequately and securely support electrical system components in a neat and workmanlike manner in accordance with NECA 1.

- C. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- D. Provide seismic bracing for all supported items in accordance with Section 01 4100.
- E. Install surface-mounted cabinets and panel boards with minimum of 4 anchors.
- F. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- G. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- H. Unless specifically indicated or approved by Architect-Engineer, do not provide support from suspended ceiling support system or ceiling grid.
- I. Unless specifically indicated or approved by Architect-Engineer, do not provide support from roof deck.
- J. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- K. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use sheet metal channel to bridge studs above and below cabinets and panel boards recessed in hollow partitions.
 - 4. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 5. Use expandable column inserts for mounting equipment inside the web of building columns.
 - 6. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
 - 7. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- L. Conduit Support and Attachment: Also comply with Section 26 0534.
- M. Box Support and Attachment: Also comply with Section 26 0537.
- N. Interior Luminaire Support and Attachment: Also comply with Section 26 5100.
- O. Exterior Luminaire Support and Attachment: Also comply with Section 26 5600.
- P. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- Q. Secure fasteners according to manufacturer's recommended torque settings.
- R. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Clean damaged areas of pre-painted materials and apply primer and finished coat in accordance with manufacturer's instructions.
- E. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 0534

CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.
- H. Liquidtight flexible nonmetallic conduit (LFNC).
- I. Conduit fittings.
- J. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 8413 - Through-Penetration Firestop Systems.
- B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
 - 1. Includes additional requirements for fittings for grounding and bonding.
- D. Section 26 0529 - Hangers and Supports for Electrical Systems.
- E. Section 26 0537 - Boxes.
- F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 31 2316 - Excavation.
- H. Section 31 2323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); National Electrical Contractors Association; 2006.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); National Electrical Contractors Association; 2003.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).
- H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association; 2005.
- I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; National Electrical Manufacturers Association; 2003.

- J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004.
- K. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- N. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- O. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- P. UL 651 - Schedule 40 and 80 Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- Q. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- R. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- S. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
 - 4. Coordinate work with other trades to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
 - 5. Notify Architect-Engineer of any conflicts with or deviations from contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Shop Drawings:
 - 1. Include proposed locations of roof penetrations and proposed methods for sealing.
- D. No product submittals required.
- E. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit or rigid PVC conduit (Schedule 40).
 - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit or rigid PVC conduit (Schedule 80).
 - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit or rigid PVC conduit (Schedule 40).
 - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit shall be made at a minimum of 12 inches below grade before emerging from underground.
 - 5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
 - 6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
 - 7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 12 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
- D. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- E. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, ~~intermediate metal conduit (IMC), or electrical metallic tubing (EMT).~~
- F. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, ~~intermediate metal conduit (IMC), or electrical metallic tubing (EMT).~~
- G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- H. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
 - 1. Locations subject to physical damage include, but are not limited to:
 - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
 - b. Where exposed below 20 feet in warehouse areas.
- J. Exposed, Exterior: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- L. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
 - 1. Maximum Length: 6 feet.
- M. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use liquidtight flexible metal conduit.

2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Maximum Length: 6 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.

2.02 CONDUIT REQUIREMENTS

- A. Fittings for Grounding and Bonding: Also comply with Section 26 0526.
- B. Provide conduit, fittings, supports, and accessories required for a complete raceway system.
- C. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for purpose indicated.
- D. Minimum Conduit Size, Unless Otherwise Indicated:
 1. Branch Circuits: 3/4 inch (21 mm) trade size.
 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
 3. Control Circuits: 3/4 inch (21 mm) trade size.
 4. Flexible Connections to Luminaires: 3/4 inch (21 mm) trade size.
 5. Underground, Interior: 3/4 inch (21 mm) trade size.
 6. Underground, Exterior: 1 inch (27 mm) trade size.
- E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- F. Conduit Size: Comply with NFPA 70 unless larger size is indicated on Contract Documents.
 1. Minimum Size: 3/4 inch unless otherwise specified.
- G. Underground Installations.
 1. See Section 26 0543 for additional requirements.
 2. More than 5 Feet from Foundation Wall.
 - a. Over 600 volts: Use nonmetallic conduit, concrete encased.
 - b. 600 volts and below: Use nonmetallic conduit, direct burial.
 3. Within 5 Feet from Foundation Wall.
 - a. Over 600 volts: Use rigid steel conduit, concrete encased.
 - b. 600 volts and below: Use rigid steel conduit, direct burial.
 4. Under slab on grade outside of building perimeter.
 - a. Over 600 volts: Use rigid steel conduit, concrete encased.
 - b. 600 volts and below: Use rigid steel conduit, direct burial.
 5. For all Bends: Use rigid steel conduit.
 6. For Fire Pump Feeders: Use rigid steel conduit, concrete encased.
 7. In or Under Slab on Grade: Use rigid steel conduit.
 8. Minimum Size: 3/4 inch.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 1. Allied Tube & Conduit: www.alliedeg.com.
 2. Republic Conduit: www.republic-conduit.com.
 3. Wheatland Tube Company: www.wheatland.com.
 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 1. Manufacturers:
 - a. Bridgeport Fittings Inc.: www.bptfittings.com.
 - b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
 1. Allied Tube & Conduit: www.alliedeg.com.
 2. Wheatland Tube Company: www.wheatland.com.
 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
 1. Manufacturers:
 - a. Bridgeport Fittings Inc.: www.bptfittings.com.
 - b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers.
 1. Thomas & Betts Corporation: www.tnb.com.
 2. Robroy Industries: www.robroy.com.
 3. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.
- D. PVC-Coated Fittings:
 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.
- E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.
- F. Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick.
- G. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.06 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers.
 1. AFC Cable Systems, Inc.: www.afcweb.com.
 2. Electri-Flex Company: www.electriflex.com.
 3. International Metal Hose: www.metalhose.com.
 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

- C. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.
- D. Fittings: NEMA FB 1.
 - 1. Secured by clamping action around periphery of conduit.
 - 2. Use of setscrews to anchor conduit is unacceptable.

2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers.
 - 1. AFC Cable Systems, Inc.: www.afcweb.com.
 - 2. Electri-Flex Company: www.electriflex.com.
 - 3. International Metal Hose: www.metalhose.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc.: www.bptfittings.com.
 - b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.

2.08 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers.
 - 1. Allied Tube & Conduit: www.alliedeg.com.
 - 2. Beck Manufacturing, Inc.: www.beckmfg.com.
 - 3. Republic Conduit: www.republic-conduit.com.
 - 4. Wheatland Tube Company: www.wheatland.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc.: www.bptfittings.com.
 - b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
 - c. Thomas & Betts Corporation: www.tnb.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.
 - 4. Connectors and Couplings: Use compression (gland) or set-screw type.
 - a. Do not use indenter type connectors and couplings.
- D. Fittings: NEMA FB 1.
 - 1. Zinc-plated steel.
 - 2. Compression type.

2.09 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers.
 - 1. Cantex Inc.: www.cantexinc.com.

2. Beck Manufacturing, Inc.: www.beckmfg.com.
 3. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com
 4. JM Eagle: www.jmeagle.com.
 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.
- D. Standard lengths with tapered ends and matching solvent-weld couplings.

2.10 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

- A. Manufacturers:
1. AFC Cable Systems, Inc.: www.afcweb.com.
 2. Electri-Flex Company: www.electriflex.com.
 3. International Metal Hose: www.metalhose.com.
 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.
- C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

2.11 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

2.12 CONDUIT SLEEVES

- A. Schedule 40 black steel.
- B. Minimum Size: 2-1/2 inches.
- C. Thread each end, cap unused sleeves.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit securely in neat and workmanlike manner in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

- E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by manufacturer.
- F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- G. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.
- H. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated and routing is not shown, determine exact routing required.
 - 3. Verify routing and termination locations of conduit prior to rough-in.
 - 4. Conceal conduit in all public areas such as offices and similar finished areas.
 - 5. Conceal conduits unless specifically indicated to be exposed.
 - 6. Conduits in following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Telecom rooms.
 - d. Within joists in areas with no ceiling.
 - 7. Unless otherwise approved, do not route conduits exposed:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 - 8. Route exposed conduit parallel and perpendicular to walls.
 - 9. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
 - 10. Route conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 11. Arrange conduit to maintain adequate headroom, clearances, and access, and present neat appearance
 - 12. Arrange conduit to provide no more than equivalent of four 90 degree bends between pull points.
 - 13. Arrange conduit to provide no more than 150 feet between pull points.
 - 14. Bends and offsets.
 - a. Make changes in direction of conduit runs with symmetrical bends, fittings, or pull boxes.
 - b. Do not use bends around outside corners, use fittings.
 - c. Minimum Radius of Curvature.
 - 1) 24 inches for 2 and 2-1/2 inch conduit.
 - 2) 36 inches for 3 inch and larger conduits.
 - 15. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch size.
 - 16. Except where conduit runs are shown in exact detail, install pull points at maximum of 200 foot intervals in straight runs.
 - 17. Group related conduits; support using trapeze or conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
 - 18. Route conduits above water and drain piping where possible.
 - 19. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
 - 20. Maintain minimum clearance of 12 inches between conduits and hot surfaces exceeding 104 degrees F. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.
 - 21. Group parallel conduits in same area together on common rack.

22. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation specification.
- I. Conduit Support:
 1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by authority having jurisdiction.
 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 3. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
 4. Arrange supports to prevent misalignment during wiring installation.
 5. Support single conduits using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
 6. Support exposed conduit at minimum of.
 - a. Every 8 feet for conduit smaller than 2 inches.
 - b. Every 10 feet for conduit 2 inches and larger.
 7. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 8. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
 9. Use conduit clamp to support single conduit from beam clamp or threaded rod.
 10. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
 - J. Connections and Terminations:
 1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Provide conduit nipples with two independent sets of threads.
 4. Use suitable adapters where required to transition from one type of conduit to another.
 5. Provide drip loops for liquid-tight flexible conduit connections to prevent drainage of liquid into connectors.
 6. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 7. Double Locknuts and Bushings.
 - a. Install on rigid conduit terminations into threadless openings.
 - b. Increase length of conduit threads at terminations sufficiently to allow bushing to be fully seated against end of conduit.
 8. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations.
 9. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 10. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
 11. Where conduit joints occur in wet or damp locations, or in concrete encasement, make joints watertight by applying an acceptable compound on the entire thread area before assembling.
 12. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
 - K. Penetrations:
 1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.

4. Install conduit sleeves for exposed conduits or cables passing through walls, floors or other masonry construction.
 - a. Extend conduit sleeves 2 inches past outside surface of wall or floor.
 - b. Fill void between sleeve and conduit with suitable caulking to maintain rating of wall or floor. Fill void flush with end of sleeve.
 5. Conceal bends for conduit risers emerging above ground.
 6. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
 7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
 9. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8413.
- L. Underground Installation:
1. Provide trenching and backfilling in accordance with Sections 31 2316 and 31 2323.
 2. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 24 inches.
 - b. Under Slab on Grade: 12 inches to bottom of slab.
 3. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.
- M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where conduits are subject to earth movement by settlement or frost.
- N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at accessible point near penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- O. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- P. Provide grounding and bonding in accordance with Section 26 0526.
- Q. Identify conduits in accordance with Section 26 0553.
- R. Install Expansion Joints.
1. In exposed conduit runs of excessive length, crossing building expansion joints, and as indicated on contract drawings.
 2. In straight runs of aluminum conduit at maximum intervals of 80 feet.
- S. Cut conduit square using saw or pipecutter; de-burr cut ends.
- T. Bring conduit to shoulder of fittings; fasten securely.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

- D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 0537

BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Wall and ceiling outlet boxes.
- D. Pull and junction boxes.

1.02 RELATED REQUIREMENTS

- A. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0529 - Hangers and Supports for Electrical Systems.
- D. Section 26 0534 - Conduit:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 2726 - Wiring Devices:
 - 1. Wall plates in finished areas.
 - 2. Additional requirements for locating boxes for wiring devices.
- G. Section 27 1005 - Structured Cabling for Voice and Data - Inside-Plant: Additional requirements for communications systems outlet boxes.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association; 2008 (Revised 2010) (ANSI/NEMA OS 1).
- E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical Manufacturers Association; 2008 (Revised 2010) (ANSI/NEMA OS 2).
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.
- K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
- L. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with dimensions and clearance requirements of actual equipment to be installed.
 - 3. Coordinate minimum sizes of boxes with actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 4. Coordinate minimum sizes of pull boxes with actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 5. Coordinate placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
 - 6. Coordinate work with other trades to preserve insulation integrity.
 - 7. Coordinate work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
 - 8. Notify Architect-Engineer of any conflicts with or deviations from contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. No product submittals required.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual locations and mounting heights of outlet and device boxes, junction boxes, pull boxes, cabinets and enclosures, floor boxes, and underground handhole enclosures.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 - 3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.

4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 5. Provide 20 per cent spare capacity in all enclosures.
 6. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
 4. Use nonmetallic boxes where exposed rigid PVC conduit is used.
 5. Use suitable concrete type boxes where flush-mounted in concrete.
 6. Use suitable masonry type boxes where flush-mounted in masonry walls.
 7. Use raised covers suitable for the type of wall construction and device configuration where required.
 8. Use shallow boxes where required by type of wall construction.
 9. Do not use "through-wall" boxes designed for access from both sides of wall.
 10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 12. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
 13. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 14. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
 15. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
 - b. Communications Systems Outlets: Comply with Section 27 1005.
 - c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
 16. Wall Plates: Comply with Section 26 2726.
 17. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Cooper Industries: www.cooperindustries.com.
 - b. Hubbell Incorporated; Bell Products: www.hubbell-bell.com.
 - c. Hubbell Incorporated; RACO Products: www.hubbell-raco.com.
 - d. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
 - e. Thomas & Betts Corporation: www.tnb.com.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. Box Size: 24 inches wide by 6 inches deep.
 3. Provide metal barriers to form separate compartments wiring of different systems and voltages.
 4. Provide accessory feet for freestanding equipment.
 5. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - a. Indoor Clean, Dry Locations: Type 12, painted steel.
 - b. Outdoor Locations: Type 3R, painted steel.

- c. Irrigation Control: Type 4, stainless-steel, outdoor rated.
 - 1) Mount 36 inches above finished grade.
 - 2) All holes to be in bottom of box.
- 6. Junction and Pull Boxes Larger than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 - b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
- 7. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
- 8. Manufacturers:
 - a. Cooper B-Line, a division of Cooper Industries: www.cooperindustries.com.
 - b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com.
 - c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com.
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURERS

- A. Appleton Electric: www.appletonelec.com.
- B. Arc-Co./Division of Arcade Technology: www.arc-co.com.
- C. Cooper Crouse-Hinds: www.crouse-hinds.com.
- D. Hoffman: www.hoffmanonline.com.
- E. Thomas and Betts Steel City: www.tnb.com.
- F. Unity Manufacturing: www.unitymfg.com.
- G. Substitutions: See Section 01 6000 - Product Requirements.

2.03 OUTLET BOXES

- A. Outlet Box Requirements.
 - 1. Flush Mounted for Single Outlet: Minimum 4 inches square by 2-1/8 inches deep.
 - 2. Data/Voice: 4-11/16 inches square by 2-1/8 inches deep with single outlet face plate.
- B. Sheet Metal Outlet Boxes: NEMA OS 1, Galvanized Steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
 - 2. Concrete Ceiling Boxes: Concrete type.
 - 3. Extensions, adapters, plaster rings, tile covers, and cover plates.
- C. Wall Plates for Finished Areas: As specified in Section 26 2726.

2.04 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Hinged Enclosures.
 - 1. Construction: NEMA 250, Type 12 steel enclosure.
 - 2. Covers: Continuous hinge, held closed by flush latch operable by screwdriver.
 - 3. Provide interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.
 - 4. Enclosure Finish: Manufacturer's standard enamel.
 - 5. Keys: Provide two of each different key.
- C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box.
 - 1. Material: Galvanized cast iron.
 - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.

- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
 - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
 - 2. Unless dimensioned, box locations indicated are approximate.
 - 3. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
 - b. Communications Systems Outlets: Comply with Section 27 1005.
 - 4. Locate boxes so that wall plates do not span different building finishes.
 - 5. Locate boxes so that wall plates do not cross masonry joints.
 - 6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 - 8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
 - 9. Fire-Resistance-Rated Walls: Install flush-mounted boxes such that the required fire-resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual non-communicating stud cavities or protect both boxes with listed putty pads.
 - 10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0534.
 - 11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.
 - b. Within joists in areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
- I. Box Supports:
 - 1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
 4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Install boxes as required to preserve insulation integrity.
- M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8413
- O. Close unused box openings.
- P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- Q. Provide grounding and bonding in accordance with Section 26 0526.
- R. Identify boxes in accordance with Section 26 0553.
- S. Install boxes securely, in neat and workmanlike manner, as specified in NECA 1.
- T. Install in locations as shown on drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.
- U. Size in accordance with NFPA 70 requirements for wiring space.
- V. Coordinate installation of outlet boxes for equipment connected in Section 26 2717.
- W. Set wall-mounted boxes at elevations to accommodate mounting heights indicated.
- X. Electrical boxes are shown on drawings in approximate locations unless dimensioned.
1. Adjust box locations up to 10 feet if required to accommodate intended purpose.
- Y. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726.
- Z. Maintain headroom and present neat mechanical appearance.
- AA. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- AB. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
1. Review characteristics of ceiling access panels with Architect-Engineer before installation.
- AC. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8413
1. Openings in rated gypsum wallboard construction not to exceed 16 square inches.
 2. Separate outlet boxes on opposite sides of fire/smoke-rated assemblies by horizontal distance of not less than 24 inches regardless of outlet size.
- AD. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- AE. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- AF. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

- AG. Locate outlets for wall switches controlling lighting on latch side of door where possible.
- AH. Use flush mounting outlet box in finished areas.
- AI. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- AJ. Provide separate boxes for emergency power and normal power systems.
- AK. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- AL. Locate outlet boxes so that wall plates do not span different building finishes.
- AM. Locate outlet boxes so that wall plates do not cross masonry joints.
- AN. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation.
 - 1. Provide minimum 24 inches separation in acoustic rated walls.
 - 2. Provide minimum 24 inches separation in fire rated walls.
- AO. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- AP. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- AQ. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- AR. Use adjustable steel channel fasteners for hung ceiling outlet box.
- AS. Do not fasten boxes to ceiling support wires.
- AT. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits, both supported within 12 inches of box.
- AU. Use gang box where more than one device is mounted together. Do not use sectional box.
- AV. Use cast outlet box in exposed industrial and utility areas.
- AW. Use cast outlet box in exterior locations and wet locations.
- AX. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
- AY. Set floor boxes level.
- AZ. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.03 ADJUSTING

- A. Install knockout closures in unused box openings.

3.04 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.
- B. Clean exposed surfaces and restore finish.

3.05 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 0543

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2012.
- C. ASTM A858 - Standard Specification for Heat-Treated Carbon Steel Fittings for Low-Temperature and Corrosive Service; 2010a.
- D. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2011a.
- E. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 2012a.
- F. ASTM C700 - Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated; 2011.
- G. ASTM C1028 - Standard Test Method for Determining The Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method; 2007e1.
- H. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction; 2012.
- I. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012.
- J. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2012.
- K. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2006.
- L. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.
- M. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2003.
- N. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2004.
- O. NEMA TC 6 & 8 - Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installations; 2003.
- P. NEMA TC 9 - Fittings for PVC Plastic Utilities Duct for Underground Installations; 2004.
- Q. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- R. SCTE 77 - Specification For Underground Enclosure Integrity; 2010.
- S. UL (ECMD) - Electrical Construction Materials Directory; current edition.

1.02 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop drawings.
 - a. Underground duct.
- C. For Information.
 - 1. Product data.
 - a. Underground duct.

- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual routing and elevations of underground conduits and ducts, and locations and sizes of manholes.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

1.04 WARRANTY

- A. See Section 01 7800 – Closeout Submittals, for additional warranty requirements.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Bedding Materials and/or Initial Backfill.
 - 1. Options.
 - a. Well-graded natural sand, 100 percent passing No. 4 sieve and less than 10 percent passing No. 200 sieve.
 - b. Well-graded crushed stone, ASTM D448, Gradation 67.
- B. Final Backfill.
 - 1. For utilities located under slabs on ground, paving, walks, railroad tracks, and similar areas when indicated on drawings.
 - a. Well-graded granular material.
 - b. Not more than 15 percent passing No. 200 sieve.
 - c. Maximum 2 inch diameter particle size.
 - 2. For utilities not located under paved areas or railroad tracks.
 - a. Maximum 4 inch diameter particle size.
 - b. Use excavated materials if suitable.
 - c. If excavated materials unsuitable, furnish off-site, well-graded materials with maximum 4 inch diameter particle size.
- C. Underground Duct System, Concrete Encased.
 - 1. Plastic utilities duct system (power and communications).
 - a. Heavy wall (500,00 psi modulus), rigid nonmetallic conduit and fittings for underground, encased and/or direct burial and listed by UL and/or ETL.
 - b. Type EB-60 (direct burial without encasement), rated for use with 90 degree C conductors.
 - c. Conduit shall be made from polyvinylchloride compound (recognized by UL) which includes inert modifiers to improve weatherability and heat distortion.
 - d. Clean rework material, generated by manufacturer's own conduit production, may be used by same manufacturer provided end product meets requirements of this specification.
 - e. Conduit and fittings shall be homogeneous plastic material free from visible cracks, holes or foreign inclusions. Conduit bore shall be smooth and free of blisters, nicks or other imperfections which could damage conductors or cables.
 - f. Conduit fittings and cement shall be that produced by same manufacturer for compatibility and integrity of raceway system.
 - g. Conduit and fittings shall be solvent cemented in applications in accordance with manufacturer's instruction.

- h. Provide standard lengths with tapered ends and matching solvent-weld couplings.
- i. Acceptable manufacturers.
 - 1) Can-Tex Industries: www.cantexinc.com.
 - 2) Carlon: www.carlon.com.
 - 3) Heritage Plastics, Incorporated: www.heritageplastics.com.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- 2. Rigid steel conduit, elbows, and couplings.
 - a. Zinc coated (hot dipped), threaded steel in accordance with ANSI C80.1.
 - b. Bends: 48 inch radius, based on 6 inch conduit size.
 - c. Fittings: NEMA FB 1, steel.
 - d. Acceptable manufacturers.
 - 1) Allied Tube & Conduit: www.alliedtube.com.
 - 2) Beck Manufacturing: www.beckmfg.com.
 - 3) Wheatland Tube Company: www.wheatland.com.
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
- D. Cast-In-Place Concrete.
 - 1. Furnish concrete, forming, pouring, and reinforcing for underground duct banks, protection of direct burial conduit, equipment foundations at grade, conduit risers, and lighting standard foundations.
 - 2. Furnish waterproofing for manholes and handholes.
 - 3. Concrete characteristics.
 - a. Compressive strength at 28 days: 3000 psi.
 - b. Minimum cement content: 5.8 bags per cubic yard.
 - c. Maximum water content: 6 gallons per bag.
 - d. Air content: 5 to 7 percent.
 - e. Maximum slump: 4 inches.
 - f. Fine and coarse aggregates in accordance with ASTM C33, Grade 60.
 - 4. Reinforcing steel: Deformed bars, in accordance with ASTM A615.
- E. Underground Line Warning Tape.
 - 1. Mark electrical underground utilities with plastic identifying tape.
 - 2. 6 inches wide.
 - 3. Print name of buried utility on nonmagnetic tape at conductive piping and magnetic at nonconductive piping.
 - 4. Imprinted continuously over entire length in permanent black ink to identify type of line.
 - a. On color red, CAUTION ELECTRIC LINE BURIED BELOW.
 - b. On color orange, CAUTION COMMUNICATION LINE BURIED BELOW.
 - 5. Acceptable manufacturers.
 - a. Allen Systems, Incorporated.
 - b. Seton Name Plate Corporation.
 - c. Terra Tape Division, Reef Industries.
 - d. Thor Enterprises.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- F. Colored Concrete
 - 1. Provide surface application of red dye to top of duct bank.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify routing and termination locations of duct bank prior to excavation for rough-in.
- C. Verify locations of manholes prior to excavation for installation.
- D. Duct bank routing shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.

- E. Manholes are shown in approximate locations unless dimensions are indicated. Locate as required to complete duct system.

3.02 INSTALLATION

- A. Excavate.
 - 1. For underground electrical systems as shown on drawings.
 - 2. Use open-cut method from surface, in accordance with levels indicated on drawings, allowing for natural sand bedding or well-graded crushed stone.
 - 3. Restrict open-cut trench excavation to trench size allowing sufficient width and depth for free working space for installation of underground duct bank, direct buried conduit, or cable systems.
- B. Bedding.
 - 1. Compact bedding in 6 inch layers to density of not less than 95 percent of maximum density as determined by Modified Proctor Method ASTM D1557.
- C. Initial Backfill.
 - 1. Extend from underground systems bedding up to height of 12 inches above top of highest duct bank, direct buried conduit, or cable in trench.
 - 2. Spread initial backfill evenly, uniformly, and compact in 6 inch layers to density of not less than 95 percent of maximum density as determined by Modified Proctor Method ASTM D1557, without causing injurious pressure or displacement of underground systems.
- D. Final Backfill.
 - 1. For utilities located under slabs on ground, paving, walks, railroad tracks, and similar areas when indicated on drawings.
 - a. Spread evenly, uniformly, and compact in 6 inch layers to density of not less than 95 percent of maximum density as determined by Modified Proctor Method ASTM D1557.
 - 2. For utilities not located under paved areas or railroad tracks.
 - a. Compact materials in 6 inch layers to density determined by Modified Proctor Method ASTM D1557 and accepted by Architect-Engineer.
 - b. Dispose of unsuitable backfill material off site.
 - 3. Under existing pavement, railroads, or similar fixed structures, use tunneling or jacking method.
 - 4. Protect excavated walls against slides and cave-ins by sloping ground, or furnish and install shoring system, sheeting, sheet piling, cribbing, or equivalent means of protection.
 - 5. Design of shoring system shall be based on depth of cut, load imposed on system by soil, water, and surcharge from equipment or structure.
 - 6. Bottom of trenches in dry earth, sand, clay, or fine gravel shall be flat.
 - 7. If rocks are encountered, excavate trenches 6 inches below bottom of electrical utility.
 - a. Install bedding, compact, and level between bottom of trench and underside of electrical utility.
 - 8. Do not backfill around concrete encasement for at least 24 hours after concrete has been placed.
 - 9. Do not disturb fresh concrete or cause damage to fresh concrete.
 - 10. Deposits of excavated material shall not interfere with Owner's or other Contractor's work.
- E. Excavation After Backfill in Engineered Fill.
 - 1. Where utilities are installed in firm, undisturbed earth, excavation may be done to suit progress of work.
 - 2. Delay utility excavation work within engineered fill and backfill areas until compaction to maximum unit density is complete.
 - 3. Testing laboratory, employed under separate Contract, to perform engineering and laboratory services in connection with control of earthwork.
 - 4. Testing laboratory, employed by General Contractor, to perform engineering and laboratory services in connection with control of earthwork.

5. Where utilities are installed in engineering fill or disturbed earth, excavate on basis of testing laboratory's verification that disturbed earth or engineered fill has been compacted or settled to Specification requirements.
 6. Testing laboratory.
 - a. Authority to approve materials, equipment, and procedures used in placing of backfill, and will determine by means of field density tests whether specific degree of compaction is obtained.
 - b. Furnish labor or incidental work required in making tests.
- F. Underground Ducts and Conduits, General.
1. Install duct or conduit to locate top of duct bank at elevations indicated in Contract Documents.
 2. Install power ducts or conduits to locate top of ductbank minimum 18 inches below finished grade.
 3. Install ducts or conduit with minimum slope of 4 inches per 100 feet (0.33 percent). Slope ducts or conduits away from building entrances.
 4. Where necessary to cut tapered end on duct or conduit, make cut with tool or lathe designed to cut taper to match taper of particular duct used.
 5. Furnish and install end bells where ducts enter manholes and handholes.
 6. Stagger joints 6 inches vertically and horizontally in horizontal duct runs and make joints watertight.
 7. Use rigid steel conduit instead of power and communication duct or conduit.
 - a. At risers.
 - b. Within 5 feet of building walls.
 - c. At all horizontal and vertical offsets and bends.
 - d. At points of strain.
 - e. At locations indicated in Contract Documents.
 - f. Furnish and install conduit adapters for connection of conduit of different materials.
 - g. For risers, use bends having minimum radius of 36 inches, unless prior approval is obtained from Architect-Engineer or indicated otherwise on drawings.
 8. Plug ends of ducts and conduits during and after construction to prevent water, mud, and debris from entering.
 9. Provide suitable pull string in each empty duct or conduit.
 10. After installation has been completed, swab ducts to remove debris.
- G. Underground Duct System, Concrete Encased.
1. Form single conduits into duct banks.
 2. Encase duct banks in concrete.
 3. Use molded plastic spacers.
 4. After duct line has been completed.
 - a. Pull standard flexible mandrel, measuring 12 inches long and 1/4 inch diameter less than inside diameter of conduit, through each conduit.
 - b. Pull brush with stiff bristles through each conduit to make certain no particles of earth, sand, or gravel have been left in conduit.
- H. Cast-In-Place Concrete.
1. Construct underground duct banks, equipment foundations, pads at grade, conduit risers, and lighting standard foundations of cast-in-place reinforced concrete.
- I. Underground Line Warning Tape.
1. Install over exterior underground power, control, signal, and communications lines to identify underground ducts and conduits, both direct buried and concrete encased.
 2. Install continuous strip located 6 to 8 inches below finished grade.
 3. Install during trench backfilling.
 4. For multiple lines buried in common trench or concrete envelope.
 - a. Install single strip if overall width of trench or concrete envelope does not exceed 16 inches.

- b. Install one additional strip for each additional 12 inches or less of width of trench or concrete envelope.

END OF SECTION

SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Floor marking tape.
- G. Warning signs and labels.

1.02 RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- B. Section 26 2726 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.
- C. Section 27 0553 - Identification for Communication Systems: Identification for communications cabling and devices.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.
- C. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007 (ANSI/ASME A13.1).
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- E. NFPA 70E - Standard for Electrical Safety in the Workplace; 2012.
- F. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
 - 1. Coordinate with work of other trades.
 - 2. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 3. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of ASME A13.1 and NFPA 70.

1.07 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Ideal Industries, Inc.: www.idealindustriesinc.com.
- B. Panduit Corporation: www.panduit.com.
- C. Thomas and Betts Corporation: www.tnb.com.

2.02 REQUIREMENTS

- A. Provide single type for each application category.
- B. Use manufacturer's standard products.
- C. Minimum character size and length of color field: Comply with ASME A13.1, Table 3, unless noted otherwise.
- D. Color: Comply with ASME A13.1 and NFPA 70.

2.03 MATERIALS

- A. Engraved Nameplates and Labels.
 - 1. Laminated phenolic engraving stock.
 - 2. Thickness: Not less than 0.062 inch.
 - 3. Legend: White background with black letters unless otherwise specified or required by national, state or local codes.
 - 4. Exceptions.
 - a. Use ring type nameplates for push buttons and pilot lights.
 - b. Warning nameplates: Yellow background with black letters.
 - c. Emergency operating signs: Red background with white letters.
- B. Adhesive Labels.
 - 1. Preprinted, flexible, self-adhesive vinyl.
 - 2. Laminate over legend with clear, and chemical weather resistant coating.
- C. Colored Adhesive Tape.
 - 1. Self-adhesive vinyl tape.
 - 2. 1 inch wide by not less than 3 mils thick.
- D. Tape Markers.
 - 1. Vinyl or vinyl cloth, self-adhesive, wrap-around tape.
 - 2. Preprinted numbers and letters.
- E. Colored Plastic Sleeves.
 - 1. Flexible, preprinted, color-coded, acrylic bands.
 - 2. Pretensioned, wrap-around, to provide gripping action when placed in position.
 - 3. Sized to suite diameter of line identified.
- F. Plasticized Card Stock.
 - 1. Vinyl cloth with eyelet for fastener.
 - 2. Preprinted and field printed legends.
 - 3. Orange background, except where indicated otherwise.
- G. Aluminum-Faced Card Stock Tags.
 - 1. Weather resistant card-stock.
 - 2. Facing on both sides, embossable aluminum sheet, 0.002 inch thick.
 - 3. Laminated with moisture resistant acrylic adhesive.
 - 4. Preprinted legend.
 - 5. Punched for fastener.
- H. Underground Line Warning Tape.

1. Permanent, bright-colored continuously printed, vinyl tape.
 2. 4 inches wide by not less than 4 mils thick.
 3. Embedded continuous metallic stripe or core.
 4. Material compounded for permanent direct-burial.
 5. Legend: Type of underground.
- I. Danger Signs.
1. Rigid type.
 - a. In compliance with OSHA standards.
 - b. Material: Fiberglass.
 - c. Thickness: 1/8 inch.
 - d. Nominal Size: 10 inches high by 14 inches wide.
 - e. Legend: Embedded.
 - f. Corners: Grommited for fasteners.
 2. Self-adhesive type.
 - a. In compliance with OSHA standards.
 - b. Preprinted, flexible self-adhesive vinyl.
- J. Fasteners for Plastic-Laminated, Fiberglass and Metal Signs.
1. Self-tapping machine screws.
 2. No. 10/32 stainless steel with nuts, flat washers, and lock washers.
- K. Convenience Receptacle Labels.
1. Adhesive type.
 2. 3/8 inch width with 1/4 inch character height.
 3. Orange background with black letters.
- L. Cable Ties.
1. Fungus-inert self-extinguishing, type 6/6 nylon.
 2. One-piece, self-locking.
 3. Width: Not less than 3/16 inch.
 4. Tensile Strength: 50 pound minimum.
 5. Temperature Range: Minus 40 degrees C to 85 degrees C.

2.04 APPLICATION

- A. Provide identification where specified, indicated and as required by OSHA and NFPA 70.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations used in Contract Documents or required by codes and standards.
- C. Use consistent designations throughout project.
- D. Engraved Nameplates and Signs.
 1. For equipment identification on.
 - a. Electrical distribution and control equipment.
 - b. Central and master units of each system.
 - c. Control devices (push buttons, selector switches, pilot lights, etc.).
 - d. Tap boxes, access doors and panels for concealed electrical work.
 2. Legends.
 - a. Tap box.
 - 1) Primary protective device.
 - 2) Feeder number.
 - 3) Character height: 2-1/2 inches.
 - b. Starter, disconnect switch, transformer, combination starter and control panel.
 - 1) Device name.
 - 2) Protective device name and location.
 - 3) Load name.
 - 4) Character height: 3/16 inch.

- c. Motor control center, fusible power panel and circuit breaker panel.
 - 1) Device name.
 - 2) Protective device and location.
 - 3) Character height: 3/16 inch.
 - d. Push button, selector switch, pilot light and control devices.
 - 1) Function (e.g., start, stop, etc.).
 - (a) Device manufacturer's nameplate is acceptable.
 - 2) When remotely mounted, identify.
 - (a) Device name.
 - (b) Name and location of device controlled.
 - 3) Character height: 1/8 inch.
 - e. Convenience receptacle labels.
 - 1) Source panel name.
 - 2) Circuit number.
- E. Raceway Identification.
- 1. Identify raceway systems as indicated in this section.
 - 2. Provide single type of identification for each application.
 - 3. Identify system voltage.
 - a. Provide identification on 15kV and 5kV raceways.
 - b. Use adhesive labels, colored plastic sleeves, plasticized cardstock, stock tags, tape markers, or painted stencil.
 - c. Orange background with black characters.
 - 4. Identify system type.
 - a. Provide color bands to identify system.
 - b. Use paint.
 - c. Width per color band: 2 inches.
 - d. Completely encircle conduit.
 - e. Band exposed and accessible raceways of the following systems with the colors indicated.
 - 1) Normal Power: Silver (unpainted).
 - 2) Emergency Power (NEC Art. 700): Yellow.
 - 3) Emergency Power (NEC Art. 701 and 702): Orange.
 - 4) Fire Alarm: Red.
 - (a) Conduits shall be red in color throughout.
 - 5) Fire suppression supervisory and control system: Red.
 - 6) Telecommunications: White.
 - 7) Security system: Blue.
 - 5. Identify raceways at.
 - a. Changes in direction.
 - b. Penetrations of walls and floors.
 - c. 50 feet maximum intervals in straight runs.
 - d. 25 feet maximum intervals in congested areas.
- F. Junction Box Identification.
- 1. Paint covers of junction boxes to identify system with following colors.
 - a. Normal Power: Silver (unpainted).
 - b. Emergency Power (NEC Art. 700): Yellow.
 - c. Emergency Power (NEC Art. 701 and 702): Orange.
 - d. Fire Alarm: Red.
 - e. Fire suppression supervisory and control system: Red.
 - f. Telephone/Data: White.
 - g. Security: Blue.
- G. Conductor Identification.
- 1. Conductor insulation color.

- a. Factory apply to entire length of conductors.
- b. Color code.
 - 1) Line and load circuits, AC or DC, above 100 volts: Black.
 - 2) AC control circuits, 150 volts and below: Red.
 - 3) DC control circuits, 150 volts and below: Blue.
 - 4) Equipment grounding conductors (noncurrent carrying): Green with or without white stripe.
 - 5) Grounded conductors (current carrying) 6 AWG and smaller: White.
- 2. Conductor phase identification.
 - a. Unique color scheme for each system voltage.
 - b. In absence of Owner's standard or existing site color scheme, use following.
 - 1) 480/277 volt system.
 - (a) Phase A: Brown.
 - (b) Phase B: Orange.
 - (c) Phase C: Yellow.
 - (d) Neutral: Gray.
 - (e) Ground: Green.
 - 2) 208/120 volt system.
 - (a) Phase A: Black.
 - (b) Phase B: Red.
 - (c) Phase C: Blue.
 - (d) Neutral: White.
 - (e) Ground: Green.
 - 3) Use color coding to identify phase and grounded conductors at each terminal and splice.
 - 4) Use consistent method throughout installation.
 - 5) Color coding system.
 - (a) Colored adhesive tape.
 - (1) Width: 1 inch.
 - (2) Half-lap turns for distance of 3 inches from terminal points, splices and taps.
 - (3) Last two laps without tension to prevent unwinding.
 - (4) Avoid obscuring cable identification markings.
 - (b) Colored cable ties.
 - (1) Apply in groups of three ties of specified color to each wire at each terminal and splice.
 - (2) Start 3 inches from terminal or splice.
 - (3) Space 3 inches apart.
- 3. Circuit identification.
 - a. Use consistent system of tags or adhesive labels.
 - b. Identify conductors at terminations and splices.
 - c. Provide circuit identification for.
 - 1) Conductors to be extended in future.
 - (a) Indicate source and circuit numbers.
 - 2) Multiple power and/or lighting circuits in same enclosure.
 - (a) Identify each conductor with source, voltage, circuit number and phase.
 - (b) Use color coding for voltage and phase identification.
 - 3) Multiple control and/or communications circuits in same enclosure.
 - (a) Identify each conductor by its system and circuit designation.
- H. Danger Signs.
 - 1. Provide danger signs.
 - a. Where required by OSHA.
 - b. At entrances to substation rooms.

- c. On covers of pull and junction boxes of systems over 600 volts.

2.05 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Switchboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use identification nameplate to identify main overcurrent protective device.
 - 5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Panelboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
 - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - c. Transformers:
 - 1) Identify kVA rating.
 - 2) Identify voltage and phase for primary and secondary.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify load(s) served. Include location when not within sight of equipment.
 - d. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - b. Use identification nameplate at each piece of service equipment to identify the available fault current and the date calculations were performed.
3. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
 - a. Minimum Size: 3.5 by 5 inches.
 - b. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data:
 - 1) Include orange header that reads "WARNING" where calculated incident energy is less than 40 calories per square cm.
 - 2) Include red header that reads "DANGER" where calculated incident energy is 40 calories per square cm or greater.
 - 3) Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
 - 4) Include following information:

- (a) Arc flash protection boundary.
 - (b) Incident energy.
 - (c) Hazard/risk category.
 - (d) PPE (personnel protective equipment) requirements.
 - (e) Nominal voltage.
 - (f) Shock hazard condition.
 - (g) Limited approach boundary.
 - (h) Restricted approach boundary.
 - (i) Prohibited approach boundary.
 - (j) Equipment identification.
 - (k) Date calculations were performed.
- 4. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
- B. Identification for Conductors and Cables:
 - 1. Color Coding for Power Conductors 600 V and Less:
 - 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

2.06 UNDERGROUND WARNING TAPE

- A. Manufacturers:
 - 1. Brady Corporation: www.bradyid.com.
 - 2. Brimar Industries, Inc.: www.brimar.com.
 - 3. Seton Identification Products: www.seton.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- D. Legend: Type of service, continuously repeated over full length of tape.
- E. Color:
 - 1. Tape for Buried Power Lines: Black text on red background.
 - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.07 FLOOR MARKING TAPE

- A. Manufacturers:
 - 1. Brady Corporation: www.bradyid.com.
 - 2. Brimar Industries, Inc.: www.brimar.com.
 - 3. Seton Identification Products: www.seton.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches wide, with alternating black and white stripes.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products centered, level, and parallel with lines of item being identified.

- C. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- D. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- E. Mark all handwritten text, where permitted, to be neat and legible.
- F. Install nameplates and labels parallel to equipment lines.
- G. Secure nameplates to equipment front using metallic drive screws except.
 - 1. Where otherwise specified.
 - 2. For devices subject to periodic replacement or removal for repair, mount nameplates separate from and adjacent to the device.
- H. Clean surfaces of dust, loose materials and oily films before applying adhesive identification products.
- I. Install cable ties with special tools or pliers. Tighten to snug fit and cut off excess.
- J. Complete panel directory for each panelboard.
 - 1. Clearly type directory and mount inside panel door.
 - 2. Provide complete description of items controlled by each individual breaker.
- K. Convenience Receptacle Labels.
 - 1. Install on faceplate of receptacle where easily visible.
 - 2. Install at consistent location throughout.
- L. Underground Line Warning Tape.
 - 1. Install over exterior underground power, control, signal, and communications lines to identify underground wiring, both direct buried and in raceway.
 - 2. Install continuous strip located 6 to 8 inches below finished grade.
 - 3. Install during trench backfilling.
 - 4. For multiple lines buried in a common trench or concrete envelope.
 - a. Install single strip if overall width of trench or concrete envelope does not exceed 16 inches.
 - b. Install one additional strip for each additional 12 inches or less of width of trench or concrete envelope.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 26 0576
ARC FLASH STUDIES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 26 0553: Identification for Electrical Systems.

1.02 REFERENCE STANDARDS

- A. ANSI Z535.4 - Product Safety Signs and Labels: American National Standards Institute; 2011.
B. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations: Institute of Electrical and Electronic Engineers; 2002 with amendments.
C. NFPA 70 - National Electrical Code: National Fire Protection Association; 2011.
D. NFPA 70E - Standards for Electrical Safety Requirements for Employee Workplaces: National Fire Protection Association; 2012 with errata.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate installation of arc flash warning labels with size, location and installation of protective devices and disconnecting means.
B. Existing Arc Flash Labeling: Coordinate with existing arc flash labeling and site safety plan.
C. Sequencing: Ensure that arc flash labeling is in place to allow for equipment startup per project schedule.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Study Preparer's Qualifications.
C. For Review.
1. Study Report.
2. Samples of proposed arc flash warning labels, one of each type and size.
D. For Close-out.
1. Project Record Documents: Final version of arc flash study.
a. Include hard copy in operation and maintenance data submittal.
b. CD-ROM copy of the following.
1) Spread sheet of electrical system data collected.
2) Spread sheet of calculated arc flash data for each piece of equipment.
(a) Bus voltage.
(b) Three phase bolted fault.
(c) Arc flash boundary.
(d) Working distance.
(e) Three phase energy level in calories/square centimeter.
(f) PPE Class per IEEE 1584.
3) Prepare files using software package, on CD-ROM, with file name cross-references to specific pieces of equipment and systems.
4) Arc flash hazard warning labels for each piece of equipment.

1.05 ARC FLASH STUDY

- A. Arc Flash Data Collection
1. Create and maintain up-to-date spreadsheet of electrical system information as installed. For each protective device or disconnecting means installed track following.
a. Load description.
1) Unique device or load name.
2) Load type.
b. Source information.
1) Unique source name.

- 2) Protective device type including make and model number.
 - 3) Protective device settings or fuse size.
 - c. Feeder or branch circuit description.
 - 1) Size and number of conductors
 - 2) Length of conductors as installed.
 - 2. Exclude loads served from transformers with secondary of 240 volts or less and rating of 125 KVA or less.
- B. Analyze specific electrical and utilization equipment (according to NEC definition), actual protective devices to be used, and actual feeder lengths to be installed.
- 1. Scope of Studies: New protective devices and disconnecting means, from primary source to buses, branch circuit panelboards and disconnecting means at individual loads. Exclude equipment served from transformers with secondary of 240 volts or less and rating of 125 KVA or less.
 - 2. Primary Source, for Purposes of Studies: Utility company primary protective devices.
 - 3. Study Methodology: Comply with requirements and recommendations of IEEE 1584.
 - 4. Report: State methodology and rationale employed in making each type of calculation; identify computer software package(s) used.
- C. Arc Flash Warning Labels.
- 1. Provide arc flash warning label information for each device on CD-ROM.
 - a. Format arc flash warning label information for printing with commercial label making system.
 - b. In compliance with ANSI Z535.4 and Owner's standards.
 - c. Arc flash warning label information for each device to include.
 - 1) Device name.
 - 2) Calculated energy level in calories/square centimeter.
 - 3) Flash hazard boundary.
 - 4) PPE Category.
 - 5) Voltage.
 - 6) Limited, restricted, and prohibited shock distances.
 - d. Coordinate label information and layout with existing site programs and arc flash warning labels.
 - 2. Provide self adhesive type arc flash warning labels for each piece of equipment.

1.06 QUALITY ASSURANCE

- A. Study Preparer Qualifications: Qualified engineer of equipment manufacturer or approved Professional Electrical Engineer licensed in the State in which the Project is located.
- B. Computer Software for Study Preparation: Use latest edition of commercially available software utilizing specified methodologies.
 - 1. Acceptable Software Products for Arc Flash Studies:
 - a. EDSA Micro Corporation: www.edsa.com.
 - b. ESA; EasyPower: www.easypower.com
 - c. Operation Technology, Inc; ETAP: www.etap.com.
 - d. SKM Systems Analysis, Inc; Power Tools for Windows: www.skm.com.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- C. Contractor Responsibility: Provide all project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, and actual circuit lengths.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Clarion: www.safetylabel.com.
- C. DuraLabel Supplies: www.duralabelsupplies.com.
- D. Seton Identification Products: www.seton.com/aec.

- E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Adhesive Labels
 - 1. Self adhesive, printable vinyl material.
 - 2. Die cut or roll type for use with printing system.
 - 3. Water and chemical resistant finish.
 - 4. White background with black printing.
 - 5. Color Band: Selected by PPE category as determined by calculations.
 - a. Red "DANGER" heading.
 - b. Orange "WARNING" heading.
 - c. Other headings as directed by Owner.
 - 6. Minimum 3 inches tall by 3 inches wide. Select size to suit application.

PART 3 EXECUTION

3.01 PREPARATION

- A. Surface Preparation:
 - 1. Verify that label size selected will fit without interfering with other labeling and will be readily visible in location chosen.
 - 2. Clean surfaces of dust, loose materials and oily films before applying adhesive labeling products.

3.02 INSTALLATION

- A. Install labels in accordance with manufacturer's instructions.
- B. Install labels parallel to equipment lines.
- C. Do not cover or interfere with equipment nameplates, instruction signs or warning labels.

END OF SECTION

SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 26 0130 - Acceptance Testing
- B. Section 26 0529 - Hangers and Supports for Electrical Systems.
- C. Section 26 0537 - Boxes: Switch outlet boxes and installation of switch device.
- D. Section 26 0553 - Identification for Electrical Systems.
- E. Section 26 2416 - Panelboards.
- F. Section 26 2726 - Wiring Devices.
- G. Section 26 2813 - Fuses.

1.02 REFERENCE STANDARDS

- A. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated 600 Volts; 2000 (Errata 2008).
- B. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks; 2010.
- C. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2000 (Reaffirmed 2010).
- D. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2011).
- E. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); 2001 (Reaffirmed 2006).
- F. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2010).
- G. NEMA WD 6 - Wiring Devices - Dimensional Requirements; 1993 (Reaffirmed 2011).
- H. NFPA 70 - National Electrical Code; 2008.
- I. UL (ECMD) - Electrical Construction Materials Directory; Underwriters Laboratories; current edition.
- J. UL 924 - Emergency Lighting and Power Equipment; 2009 (2011).

1.03 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. Product Data: Provide dimensions, size, voltage ratings and current ratings.
- C. Shop Drawings: Indicate wiring diagrams of system, showing interface with branch circuit wiring.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual locations of components and record circuiting and switching arrangements.
- F. Maintenance Data: Include replacement parts numbers.
- G. Maintenance Materials
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Furnish 2 spares of each: wall dimmers, photoelectric controllers, occupancy sensors, switches, power packs, and relays.
- H. For Information and closeout.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by Underwriters Laboratories as suitable for purpose specified and indicated.

PART 2 PRODUCTS

2.01 WALL DIMMER

- A. Wall Dimmers: Semiconductor dimmer for incandescent lamps, Type as indicated on drawings, complying with NEMA WD 6 and WD 1.
 - 1. Switch Colors: White.
 - 2. Control: Linear slide with integral preset on-off switch to shut off power when lighting is not in use.
 - 3. Voltage: 120 volts.
 - 4. Load type and operation.
 - a. Incandescent, dim lamps from full brightness to full off.
 - b. Fluorescent, dim lamps from full brightness to 10 percent of light output. Dimmer compatible with lamp ballast.
 - c. Single point or three way as indicated on drawings.
 - 5. Solid-state circuit with integral RF interference filter. Lamp filament hum, radio and TV interference produced by dimmer is unacceptable.
 - 6. Power Rating: As indicated in schedule on drawings.
 - 7. Match devices in multi-gang installations.
 - 8. Acceptable manufacturers.
 - a. Leviton Manufacturing, Inc.: www.leviton.com.
 - b. Lutron Electronics, Inc.: www.lutron.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- B. Accessory Wall Switches: Match dimmer appearance.

2.02 PHOTOELECTRIC CONTROLLERS

- A. Description: Photoelectric switch for control of lighting based on ambient light levels.
- B. Sensor Type: Cadmium sulphide, epoxy coated.
- C. Construction: Weatherproof for outdoor mounting.
- D. Operating Voltage: 120, 277, and 480 volts AC.
- E. Contacts: Single pole-single throw, normally closed, fails in on position.
- F. Temperature Range: Minus 40 to plus 60 degrees C.
- G. Activation Range.
 - 1. Turn-on: 1 to 5 footcandles, field adjustable using sliding shutter.
 - 2. Turn-off: 5 to 15 footcandles.
- H. Time delay feature to prevent switching of lights due to transient lighting changes.
- I. Enclosure Type and Rating.
 - 1. Metallic enclosure for direct mounting on 1/2 inch conduit stem.
 - a. Rated minimum of 2000 watts resistive, 1800VA inductive at 120 volts.
 - b. Rated minimum of 7200 watts resistive, 4000VA inductive at 480 volts.
 - 2. Single-gang outlet box mounting.
 - a. Rated minimum of 1800 watts resistive, 1000VA inductive at 120 volts.
 - b. Rated minimum of 7200 watts resistive, 4000VA inductive at 480 volts.
- J. Acceptable Manufacturers.
 - 1. Fisher Pierce: www.fisherperceolc.com.
 - 2. Intermatic: www.intermatic.com.
 - 3. Paragon Electrical Products: www.icca.invensys.com.
 - 4. Tork: www.tork.com.

5. Substitutions: See Section 01 6000 - Product Requirements.

2.03 OCCUPANCY SENSORS

- A. Description: Commercial grade sensors and accessories to automatically switch lighting or electrical equipment in response to room occupancy.
- B. General Requirements.
 - 1. Design: For mounting and space detection coverage requirements indicated.
 - 2. Connection: Receive power from lighting circuit.
 - 3. Operation.
 - a. Turn lights on when room or covered area is occupied, and off when unoccupied, except as otherwise indicated.
 - b. Time delay for turning lights off, fully adjustable within 7 seconds to 15 minutes.
 - c. Adjustable ambient light override to prevent turning lights on during periods of ample natural light.
 - 4. Compatible with.
 - a. Fluorescent and incandescent lamp operation.
 - b. Electronic and magnetic ballasts.
 - 5. Select sensor to provide full room coverage.
- C. Sensor Configuration.
 - 1. Wall switch type with integral override switch.
 - a. Sensor: Dual technology, Passive infrared, Ultrasonic, or as indicated on the drawings.
 - b. Beam spread: 180 degrees.
 - c. Coverage: 1200 square feet, minimum.
 - d. Operating voltage: 120 or 277 VAC.
 - e. Time delay: Adjustable, 0.5 to 20 minutes.
 - f. Color: White, Ivory, Almond, or Gray.
 - g. Integral light sensor: Adjustable from 5 to 200 FC.
 - h. Suitable for low temperature and high humidity applications.
 - i. No minimum load requirement for proper operation.
 - j. Load ratings.
 - 1) 800 watts at 120 volts, resistive.
 - 2) 1200 VA at 120 volts, inductive.
 - 3) 2700 VA at 277 volts, inductive.
 - 4) Motor load: 1/4 horsepower.
 - 2. Wall switch type with dual relay and integral override switch.
 - a. Sensor: Dual technology, Passive infrared, Ultrasonic, or as indicated on drawings.
 - b. Beam spread: 180 degrees.
 - c. Coverage: 1200 square feet, minimum.
 - d. Operating voltage: 120 or 277 VAC.
 - e. Time delay: Adjustable, 0.5 to 20 minutes.
 - f. Color: White, Ivory, Almond, or Gray.
 - g. Integral light sensor: Adjustable from 5 to 200 FC.
 - h. Suitable for low temperature and high humidity applications.
 - i. No minimum load requirement for proper operation.
 - j. Load ratings.
 - 1) 800 watts at 120 volts, resistive.
 - 2) 1200 VA at 120 volts, inductive.
 - 3) 2700 VA at 277 volts, inductive.
 - 4) Motor load: 1/4 horsepower.
 - 3. Wall or Corner mounted wide view type.
 - a. Sensor: Dual technology, Passive infrared, Ultrasonic, or as indicated on drawings.
 - b. Beam spread: 110 degrees nominal.
 - c. Coverage: 1200 square feet, minimum.

- d. Operating voltage: 12 to 24 VDC.
- e. Time delay: Adjustable, 0.5 to 20 minutes.
- f. Color: White, Ivory, or Almond.
- g. Integral light sensor: Adjustable from 5 to 200 FC.
- h. Suitable for low temperature and high humidity applications.
- 4. Wall or Corner mounted narrow view hallway type.
 - a. Sensor: Dual technology, Passive infrared, Ultrasonic, or as indicated on drawings.
 - b. Beam spread: 8 degrees nominal.
 - c. Coverage: 100 feet by 14 feet nominal.
 - d. Operating voltage: 12 to 24 VDC.
 - e. Time delay: Adjustable, 0.5 to 20 minutes.
 - f. Color: White, Ivory, or Almond.
 - g. Integral light sensor: Adjustable from 5 to 200 FC.
 - h. Suitable for low temperature and high humidity applications.
- 5. Ceiling mounted.
 - a. Sensor: Dual technology, Passive infrared, Ultrasonic, or as indicated on drawings.
 - b. Beam spread: 360 degrees.
 - c. Coverage: 2000 square feet, minimum.
 - d. Operating voltage: 12 to 24 VDC.
 - e. Time delay: Adjustable, 0.5 to 20 minutes.
 - f. Color: White.
 - g. Integral light sensor: Adjustable from 5 to 200 FC.
 - h. Suitable for low temperature and high humidity applications.
- D. Power Pack.
 - 1. Plenum-rated enclosure and wiring for mounting adjacent to fixtures controlled.
 - 2. Input Voltage: 120 or 277 VAC.
 - 3. Output Power: 150mA, 12 to 24 VDC.
 - 4. Contact Rating: 20 amperes resistive or inductive at 120 or 277 VAC.
 - 5. Switching: Zero crossing circuit to extend contact life.
 - 6. Accessories: Auxiliary relay for HVAC control.
- E. Acceptable Manufacturers.
 - 1. Lighting Control & Design: www.lightingcontrols.com.
 - 2. Leviton Manufacturing Company, Inc.: www.leviton.com.
 - 3. Hubbell Building Automation, Inc.: www.hubbell-automation.com.
 - 4. Sensor Switch, Inc.: www.sensorswitch.com.
 - 5. Watt Stopper/Legrand: www.wattstopper.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.

2.04 DIGITAL TIME SWITCH

- A. Description: Single-gang wall box mounted digital time switch for time duration control of lighting or electrical equipment.
- B. Timer Adjustment: Timer adjustment range from 5 minutes to 12 hours.
 - 1. Time scrolling options for overriding the preset time.
 - 2. Simple reset to return switch to original preset.
 - 3. Beep warning every five seconds during last minute of countdown.
 - 4. One second light flash warning at one minute remaining in countdown.
- C. Display: Backlit liquid crystal display.
- D. Color: White or Ivory with matching wall plate.
- E. Switching: Zero crossing circuit to extend contact life.
- F. Voltage: Operates at 120 or 277 VAC with no minimum load requirement.
- G. Load Types: Compatible with all ballast and motor loads.

- H. Acceptable Manufacturers.
 - 1. Leviton Manufacturing Company, Inc.: www.leviton.com.
 - 2. Sensor Switch: www.sensorswitch.com.
 - 3. Tork: www.tork.com.
 - 4. Watt Stopper/Legrand "TS-400" Series: www.wattstopper.com.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.05 LOW VOLTAGE SWITCHING PANEL

- A. Description: Programmable low voltage switching panel for use as stand-alone lighting control system to switch multiple lighting circuits with low voltage relays.
- B. Configuration.
 - 1. Relays.
 - a. 12, 24, or 48 relays rated 20 amperes at 120 or 277 volts AC.
 - b. Minimum short circuit interrupting rating: 14,000 AIC.
 - c. Single pole, mechanical latching type.
 - d. Mechanical override integral to each relay.
 - e. Individually replaceable.
 - 2. LED type relay status indicator at each relay.
 - 3. Built-in control module with seven-day operation, astronomic and automatic daylight saving function clock.
 - 4. Programmable for group switching of multiple relays.
 - 5. Integral power supply with 24 volt DC capacity for accessory devices.
 - 6. Assignable inputs for low voltage remote switches and control devices.
 - 7. Capable of controlling light circuits from remote photocell.
 - 8. Capable of overriding automatic function with use of local low voltage override switch.
 - 9. Network connection for interface with multiple relay panels or building control systems.
 - a. BACnet compatible interface.
 - 10. Enclosure Type: NEMA 1, surface mounted.
 - 11. Barrier between line voltage and low voltage sections.
- C. Acceptable Manufacturers.
 - 1. GE Industrial: www.geindustrial.com.
 - 2. Lighting Control & Design: www.lightingcontrols.com.
 - 3. Leviton: www.leviton.com.
 - 4. Lutron: www.lutron.com.
 - 5. Sensor Switch: www.sensorswitch.com.
 - 6. Watt Stopper/Legrand "L1" Series: www.wattstopper.com.
 - 7. Substitutions: See Section 01 6000 - Product Requirements.

2.06 LOW VOLTAGE MOMENTARY OVERRIDE SWITCH

- A. Description: Low voltage momentary push-button switches for local override of automatic lighting control systems. Works in conjunction with low voltage switching panel.
- B. Single or multiple button configuration as indicated on drawings.
- C. LED type pilot light status indication.
- D. Oversized push button where indicated on drawings for special functions.
- E. Normally open, 3 amp, 28 VAC contacts.
- F. Single pole-double throw momentary operation.
- G. Single- or double-gang outlet boxes.
- H. Acceptable Manufacturers.
 - 1. GE Industrial: www.geindustrial.com.
 - 2. Lighting Control & Design: www.lightingcontrols.com.
 - 3. Leviton Manufacturing, Inc.: www.leviton.com.
 - 4. Lutron: www.lutron.com.

5. Sensor Switch: www.sensorswitch.com.
6. Watt Stopper/Legrand "RS2" Series: www.wattstopper.com.
7. Substitutions: See Section 01 6000 - Product Requirements.

2.07 LOW VOLTAGE OVERRIDE TOGGLE SWITCH

- A. Description: Low voltage momentary contact toggle switches for local override of automatic lighting control systems. Works in conjunction with low voltage switching panel.
- B. Key or toggle switch configuration as indicated on drawings.
- C. Normally open, 3 amp, 24VAC/VDC.
- D. Single pole-double throw momentary operation with center position rest.
- E. Single-gang outlet box.
- F. Furnish key with switch.
- G. Acceptable Manufacturers.
 1. GE Industrial: www.geindustrial.com.
 2. Lighting Control & Design: www.lightingcontrols.com.
 3. Leviton: www.leviton.com.
 4. Lutron: www.lutron.com.
 5. Sensor Switch: www.sensorswitch.com.
 6. Watt Stopper/Legrand "LVS" Series: www.wattstopper.com.
 7. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that outlet boxes are installed at proper height.
- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- D. Coordinate with architectural plans and wall elevations.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install securely, in neat and workmanlike manner, as specified in NECA 1.
- C. Install devices plumb and level.
- D. Mount at uniform heights above floor for various areas as indicated, refer to drawings for mounting heights.
- E. Low Voltage Wiring.
 1. Will be installed in raceway and boxes per Auburn University Standards.
- F. Wall Dimmers.
 1. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
 2. Adjust threshold.
 3. Coordinate with circuit voltage, lamp and ballast type.
 4. Do not share neutral conductor on load side of dimmers.
 5. Flush mount unless noted otherwise.
- G. Photoelectric Controllers.
 1. Refer to aiming and settings on the drawings.

- H. Occupancy Sensors.
 - 1. Refer to settings and adjustments on the drawings.
- I. Plates.
 - 1. Flush-mounted outlets with four edges in continuous contact with finished wall surfaces without use of plaster mats or similar devices.
 - 2. Do not use plaster or similar fillings.
 - 3. Vertical installation, unless otherwise noted, with alignment tolerance of 1/16 inch.
- J. Mount Nonself-Supporting Enclosures.
 - 1. Secure to walls or columns with 1/4 inch minimum separation.
 - 2. Include necessary spacers, brackets, structural pieces, inserts, anchors, and supports in accordance with Section 26 0529.
- K. Provide fuses for fusible switches as specified in Section 26 2813.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 26 0130.

3.05 OPERATIONAL TESTING OF EQUIPMENT AND SYSTEMS

- A. Provide manufacturer's field representative to prepare and start equipment.
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Owner's designated representative.

3.06 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

- A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 1200
MEDIUM-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dry-type pad-mounted distribution transformers.

1.02 RELATED REQUIREMENTS

- A. Section 26 0127 - Acceptance Inspection and Testing.

1.03 REFERENCE STANDARDS

- A. IEEE C37.47 - American National Standard Specifications for Distribution Fuse Disconnecting Switches, Fuse Supports, and Current-Limiting Fuses; 2011. (ANSI/IEEE C37.47)
- B. IEEE C57.12.91 - IEEE Test Code for Dry-Type Distribution and Power Transformers; Institute of Electrical and Electronic Engineers; 2011.
- C. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; Institute of Electrical and Electronic Engineers; 2008.
- D. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers; Institute of Electrical and Electronic Engineers; 1982 (R2006)
- E. IEEE C57.111 - IEEE Guide for Acceptance of Silicone Insulating Fluid and Its Maintenance in Transformers; Institute of Electrical and Electronic Engineers; 1989 (R2003).
- F. IEEE C57.121 - IEEE Guide for Acceptance and Maintenance of Less Flammable Hydrocarbon Fluid in Transformers; Institute of Electrical and Electronic Engineers; 1998.
- G. IEEE 386 - IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600 V; Institute of Electrical and Electronic Engineers; 2011.
- H. NEMA 260 - Safety Labels for Padmounted Switchgear and Transformers Sited in Public Areas; National Electrical Manufacturers Association; 1996 (2004).
- I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).
- J. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate electrical characteristics and connection requirements, outline dimensions, connection and support points, weight, specified ratings and materials.
- C. Product Data: Provide electrical characteristics and connection requirements, standard model design tests, and options.
- D. Manufacturer's Installation Instructions.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Field Reports: Indicate activities on site, final adjustments and overcurrent protective device coordination curves, adverse findings, and recommendations.
- G. Project Record Documents: Include copy of manufacturer's certified drawings.
- H. Maintenance Data: Include maintenance instructions for cleaning methods; cleaning materials recommended; procedures for sampling and maintaining fluid.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Fuses: One of each type and size.
 - 3. Tools: One each of every special tool required to operate and maintain transformer.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.
- C. Testing Agency Qualifications: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.
- D. Products: Listed and classified by Underwriters Laboratories, Inc.
- E. Test Reports: Manufacturer to submit transformer test reports as covered in NEMA TR1-9.05 and TR1-9.06 or latest revision.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformers internal components, enclosure, and finish.
- B. Store in clean, dry space. Maintain factory wrapping, or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

PART 2 PRODUCTS

2.01 PRIMARY TRANSFORMER

- A. Pad mount transformer designed and sized by Stewart Engineering.
- B. Pad mount transformer furnished by Auburn University.
- C. Pad mount transformer installed by Electrical Contractor.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that support pads provided in Section 03 3000 are ready to receive products.

3.02 INSTALLATION

- A. Install in accordance with IEEE C57.94.
- B. Install plumb and level.
- C. Install safety labels to NEMA 260.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 26 0127.

3.04 ADJUSTING

- A. Adjust primary taps so that secondary voltage is above and within 2 percent of rated voltage.

END OF SECTION

SECTION 26 1321

MEDIUM VOLTAGE AIR INTERRUPTER SWITCHGEAR

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Medium-voltage air interrupter switches.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete pads and foundations.
- B. Section 26 0127 - Acceptance Inspection and Testing.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. ANSI Z55.1 - Gray Finish for Industrial Apparatus and Equipment; 1973
- B. IEC 62271-105 - High-Voltage Switchgear and Control Gear - Part 105: Alternating Current Switch-Fuse Combination; 2012.
- C. IEEE C37.20.4 - Standard for Indoor AC Medium Voltage Switches used in Metal-Enclosed Switchgear; Institute of Electrical and Electronic Engineers; 2001.
- D. IEEE 48 - IEEE Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV; Institute of Electrical and Electronic Engineers; 1996 (R2009).
- E. IEEE C2 - National Electrical Safety Code; Institute of Electrical and Electronic Engineers; 2012.
- F. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2011.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate outline dimensions, enclosure construction, shipping splits, lifting and supporting points, electrical single line diagram, and equipment electrical ratings.
- C. Product Data: Provide data for components and accessories.
- D. Test Reports: Indicate findings of field quality control procedures.
- E. Submit manufacturer's installation instructions.
- F. Maintenance Data: Fuse replacement, adjustment and lubrication instructions.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Fuses: One of each size and rating.
 - 3. Fuse Pulling Tools: One, with insulated-handle, designed for this type of fuse.

1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70 and IEEE C2.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect interrupter switches from weather and moisture by covering with heavy plastic or canvas and by maintaining heating within enclosure in accordance with manufacturer's instructions.
- B. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.

PART 2 PRODUCTS

2.01 AIR INTERRUPTER SELECTOR SWITCHES

- A. Pad mount selector switch designed and sized by Stewart Engineering.
- B. Pad mount selector switch furnished by Auburn University.
- C. Pad mount selector switch installed by Electrical Contractor.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation
 - 1. Receive, protect, unpack, handle, rig, assemble, install, and connect unit substation and auxiliaries for complete operation.
 - 2. Verify that NEC clearances and working space requirements are achievable with specific equipment supplied under this contract.
 - 3. Install in accordance with manufacturer's instructions.
 - 4. Install on concrete pad as indicated on Drawings.
 - 5. After switchgear has been set, accurately aligned, and shimmed, fasten to floor with 1/2 inch hardware.
- B. Protection.
 - 1. Furnish and install temporary protection for switchgear if stored on site.
 - 2. Include necessary wood doors and frame with heavy tarpaulin covers to keep out water and dust.
 - 3. If stored in unheated areas, furnish and install temporary electrical heating to prevent condensation.
- C. Danger Signs.
 - 1. Furnish and install danger signs in accordance with OSHA requirement.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 26 0127.
- B. Engineering Field Services.
 - 1. Manufacturer to provide field service engineer at site to:
 - a. Review the equipment and installation prior to energization.
 - b. Ensure correct functioning of equipment, and supervise required electrical and mechanical adjustments.
 - 2. Include living expenses, transportation expenses and wages incurred during time at site.
 - 3. Services included under this heading, Field Quality Control, are in addition to services required under paragraph titled, Submittals, Guarantee/Warranty.
 - 4. Owner will authorize and reimburse manufacturer for premium portion of Owner authorized overtime required by service engineer in accordance with General Conditions.
 - 5. Sign and return checkout lists to Owner stating that equipment is ready for energization.
 - 6. Air Interrupter Switches.
 - a. Re-examine switches for evidence of shipping, storage, or handling damage.
 - b. Identify damaged parts and reorder.
 - c. Determine shipping devices and tags have been removed or direct removal of blocking.
 - d. Operate manually to check operation of auxiliaries and interlocks.

- e. Check contact wipe, gaps, and clearances as described in manufacturer's instruction book.
- f. If equipped with electrical operation, test several times in accordance with instruction book.
- g. Verify Kirk interlocks, if furnished.
- h. Review equipment and installation prior to energization, and after equipment is placed in service.

3.03 CLOSEOUT ACTIVITIES

- A. Furnish one (1) eight hour day, as scheduled by Owner, of training classes for Owner's personnel.

END OF SECTION

SECTION 26 2200
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General purpose transformers.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 0534 - Conduit: Flexible conduit connections.
- E. Section 26 2416 - Panelboards.

1.03 REFERENCE STANDARDS

- A. IEEE C57.94 - Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers; 1982 (R2006).
- B. IEEE C57.96 - Guide for Loading Dry-Type Distribution and Power Transformers; 1999 (R2004).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- D. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2009.
- E. NEMA ST 20 - Dry-Type Transformers for General Applications; National Electrical Manufacturers Association; 1992 (R1997).
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008
- G. NEMA TP 1 - Guide for Determining Energy Efficiency for Distribution Transformers; 2002.
- H. NEMA TP 2 - Standard Test Method for Measuring the Energy Consumption of Distribution Transformers; 2005.
- I. NEMA TP 3 - Standard for the Labeling of Distribution Transformer Efficiency; 2000.
- J. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).
- K. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- L. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.
- M. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.
- N. UL (ECMD) - Electrical Construction Materials Directory;

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate work with placement of support framing and anchors required for mounting of transformers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
- C. Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

- D. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.
- E. Test Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Maintenance Data: Include recommended maintenance procedures and intervals.
- H. Project Record Documents: Record actual locations of transformers.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Ambient Temperature: Do not exceed 86 degrees F average or 104 degrees F maximum measured during any 24 hour period during and after installation of transformers.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation; Cutler-Hammer: www.eaton.com.
- B. General Electric Company: www.geindustrial.com.
- C. Schneider Electric; Square D Products: www.schneider-electric.us.
- D. Siemens Energy & Automation: www.sea.siemens.com.
- E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ALL TRANSFORMERS

- A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed and labeled by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.
- B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under following service conditions:
 - 1. Altitude: Less than 3,300 feet.
 - 2. Ambient Temperature: Not exceeding 86 degrees F average or 104 degrees F maximum measured during any 24 hour period.
- C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

- D. Impregnate core and coil assembly with non-hygroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
- E. Basic Impulse Level: 10 kV.
- F. Ground core and coil assembly to enclosure by means of visible flexible copper grounding strap.
- G. Isolate core and coil from enclosure using vibration-absorbing mounts.
- H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 TWO-WINDING TRANSFORMERS RATED FOR LINEAR LOADS

- A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on drawings.
- B. Primary Voltage: as indicated on the drawings.
- C. Secondary Voltage: as indicated on the drawings.
- D. Insulation System and Allowable Average Winding Temperature Rise:
 - 1. Less than 15 kVA: Class 185 degrees C insulation system with 115 degrees C average winding temperature rise.
 - 2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.
- E. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
- F. Winding Taps:
 - 1. Less than 3 kVA: None.
 - 2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
 - 3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
 - 4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.
- G. Energy Efficiency: Standard efficiency complying with NEMA TP 1.
 - 1. Test efficiency according to NEMA TP 2.
 - 2. Label transformer according to NEMA TP 3.
- H. Sound Levels: Standard sound levels complying with NEMA ST 20.
- I. Mounting Provisions:
 - 1. Less than 15 kVA: Suitable for wall mounting.
 - 2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
 - 3. Larger than 75 kVA: Suitable for floor mounting.
- J. Transformer Enclosure: Comply with NEMA ST 20.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor clean, dry locations: Type 2.
 - 2. Construction: Heavy gage steel.
 - a. Less than 15 kVA: Totally enclosed, non-ventilated.
 - b. 15 kVA and Larger: Ventilated.
 - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 - 4. Provide lifting eyes or brackets.
- K. Energy efficiency: Class 1, in accordance with NEMA TP-1, Table 4-2.
- L. Mounting.
 - 1. 1 to 15 kVA: Suitable for wall mounting.
 - 2. 16 to 112.5 KVA: Suitable for floor or trapeze mounting.
 - 3. Above 112.5 KVA: Suitable for floor only.

2.04 SOURCE QUALITY CONTROL

- A. Factory test transformers according to NEMA ST 20.
- B. Production test each unit according to NEMA ST 20.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
- C. Perform pre-installation tests and inspections on transformers according to manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in neat and workmanlike manner in accordance with NECA 1.
- B. Install transformers in accordance with manufacturer's instructions.
- C. Install transformers in accordance with NECA 409 and IEEE C57.94.
- D. Use flexible conduit, under provisions of Section 26 0534, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
- F. Set transformers plumb and level.
- G. Use liquidtight flexible conduit, under provisions of Section 26 0534, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- H. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by manufacturer.
- I. Mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
- J. Mount floor-mounted transformers on vibration isolating pads suitable for isolating transformer noise from building structure.
- K. Mount trapeze-mounted transformers as indicated.
- L. Provide seismic restraints.
- M. Do not locate transformer against wall or equipment which could block ventilation, see manufacturer's requirements for spacing.
- N. Provide grounding and bonding in accordance with Section 26 0526.
- O. Remove shipping braces and adjust bolts that attach core and coil mounting bracket to enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
- P. Where not factory-installed, install lugs sized as required for termination of conductors as shown on drawings.
- Q. Identify transformers in accordance with Section 26 0553.
- R. Install transformer identification nameplate in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting in accordance with Section 26 0127.

3.04 ADJUSTING

- A. Measure primary and secondary voltages and make appropriate tap adjustments.

- B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from transformer components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0529 - Hangers and Supports for Electrical Systems.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 2200 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; National Electrical Contractors Association; 2009.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.
- E. NEMA PB 1 - Panelboards; National Electrical Manufacturers Association; 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; National Electrical Manufacturers Association; 2007.
- G. NEMA AB 3 Molded Case Circuit Breakers and Their Application; current edition.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).
- I. NFPA 70 - National Electrical Code; National Fire Protection Association; 2005.
- J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- L. UL 67 - Panelboards; Current Edition, Including All Revisions.
- M. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- N. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- O. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.
- P. UL 1047 - Isolated Power Systems Equipment; 2009 (2010).
- Q. UL 1283 - Electromagnetic Interference Filters; 2005 (2009).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with dimensions and clearance requirements of actual equipment to be installed.
3. Coordinate work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with conductors to be installed.
5. Notify Architect-Engineer of any conflicts with or deviations from contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
 2. Include wiring diagrams showing all factory and field connections.
 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- G. Maintenance Materials: Furnish following for Owner's use in maintenance of project.
 1. See Section 01 6000 - Product Requirements, for additional provisions.
 2. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS (WHERE NOT SPECIFICALLY INDICATED)

- A. Eaton Electrical/Cutler-Hammer; www.eatonelectrical.com.
- B. General Electric Company; www.geindustrial.com.
- C. Schneider Electric; Square D Products; www.schneider-electric.us.

- D. Siemens: www.usa.siemens.com.
- E. Substitutions: See Section 01 6000 - Product Requirements.
- F. Source Limitations: Furnish panelboards and associated components produced by same manufacturer as other electrical distribution equipment used for this project and obtained from single supplier.

2.02 ALL PANELBOARDS

- A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for purpose indicated.
- B. Unless otherwise indicated, provide products suitable for continuous operation under following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
 - 1. Provide panelboards with listed short circuit current rating not less than available fault current at installed location as indicated on drawings.
- D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- E. Mains: Configure for top or bottom incoming feed as indicated or as required for installation.
- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide fully rated neutral bus unless otherwise indicated, with suitable lug for each feeder or branch circuit requiring neutral connection.
 - 2. Provide solidly bonded equipment ground bus in each panelboard, with suitable lug for each feeder and branch circuit equipment grounding conductor.
- H. Conductor Terminations: Suitable for use with conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- J. Future Provisions: Prepare unused spaces for future installation of devices including bussing, connectors, mounting hardware and other required provisions.
- K. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - 1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
- L. Multi-Section Panelboards: Provide enclosures of same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.
- M. Load centers are not acceptable.

- N. Provide following features and accessories where indicated or where required to complete installation:
1. Feed-through lugs.
 2. Sub-feed lugs.

2.03 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on drawings.
- B. Conductor Terminations:
1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
1. Phase and Neutral Bus Material: Aluminum.
 2. Ground Bus Material: Aluminum.
- D. Circuit Breakers:
1. Provide bolt-on type.
- E. Enclosures:
1. Provide surface-mounted enclosures unless otherwise indicated.
 2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 3. Provide clear plastic circuit directory holder mounted on inside of door.
- F. Minimum Integrated Short Circuit Series Rating:
1. See study issued with drawings.
- G. Molded Case Circuit Breakers:
1. UL 489 listed.
 2. Frame sizes smaller than 400A shall have integral thermal and instantaneous magnetic trip in each pole. Frame sizes 400A and larger to have electronic trips.
 3. For air conditioning equipment branch circuits provide molded case circuit breakers UL listed as Type HACR.
 4. Circuit Breakers use for main breaker application will be 100 percent rated.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 2. Phase and Neutral Bus Material: Aluminum.
 3. Ground Bus Material: Aluminum.
- D. Circuit Breakers: Thermal magnetic bolt-on type.
- E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
 2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 3. Provide clear plastic circuit directory holder mounted on inside of door.

- F. Minimum Integrated Short Circuit Series Rating:
 - 1. See study issued with drawings.
- G. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
 - 1. Type SWD for lighting circuits.
 - 2. Type HACR for air conditioning equipment circuits.
 - 3. Class A ground fault interrupter circuit breakers where scheduled.
 - 4. Do not use tandem circuit breakers.
- H. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards, 20 inches wide for 480 volt panelboards.

2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
 - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on drawings.
 - 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide short circuit current rating indicated, but not less than:
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - 2) 14,000 rms symmetrical amperes at 480 VAC.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Provide compression lugs where indicated.
 - c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
 - b. Provide interchangeable trip units where indicated.
 - 5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - 6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
 - 7. Provide listed switching duty rated circuit breakers with SWD marking for branch circuits serving fluorescent lighting.
 - 8. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for branch circuits serving HID lighting.
 - 9. Do not use tandem circuit breakers.
 - 10. Do not use handle ties in place of multi-pole circuit breakers.
 - 11. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

2.06 AIR CIRCUIT BREAKERS, SEPARATELY MOUNTED

- A. Molded case with thermomagnetic trip device.
- B. Rated 600 VAC, 60 hertz and 250 VDC with ampere rating and poles as indicated or required.
- C. Minimum interrupting rating of 10,000 RMS Symmetrical amperes at 240 VAC, unless indicated otherwise in study issued with drawings.
- D. Minimum interrupting rating of 14,000 RMS Symmetrical amperes at 277 VAC, unless indicated otherwise in study issued with drawings.
- E. Minimum interrupting rating of 22,000 RMS Symmetrical amperes at 480 VAC, unless indicated otherwise in study issued with drawings.

- F. Enclosure.
 - 1. NEMA 1, hinged and/or screwed.
 - 2. External operating handle.
 - 3. Neutral and ground connections as required.
 - 4. Padlock shackles, for minimum of three 5/16 inch locks, for locking operating handle in off position and venting opening of door/cover with lock in place.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify that ratings and configurations of panelboards and associated components are consistent with indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 GENERAL INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install panelboards securely, in neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26 0529.
- E. Install panelboards plumb.
- F. Install flush-mounted panelboards so that trims fit completely flush to wall without gaps and rough opening completely covered.
- G. Mount panelboards such that highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above floor or working platform.
- H. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
- I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 26 0526.
- K. Install field-installed branch devices, components, and accessories.
- L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- M. Panelboards and Supports.
 - 1. Mount nonself-supporting.
 - a. Secure to walls or columns with 1/4 inch minimum separation.
 - b. Include necessary spacers, brackets, structural pieces, inserts, anchors, and supports.
 - 2. Mount self-supporting.
 - a. Anchor equipment securely to floors or to supporting steel.
- N. Mount panelboards and individually mounted circuit breakers at uniform heights throughout buildings.
- O. Provide filler plates to cover unused spaces in panelboards.
- P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for following:
 - 1. Fire detection and alarm circuits.
- Q. Identify panelboards in accordance with Section 26 0553.

- R. Provide computer-generated circuit directory for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating loads served. Identify spares and spaces.
- S. Install handle locking devices on panelboard circuit breakers for night lighting, emergency lighting, fire alarm circuit control and similar circuits, and identify these breakers in panelboard.

3.03 IDENTIFICATION

- A. Identify panelboards and individually mounted circuit breakers using laminated white plastic nameplates with black engraved letters.
- B. Wording in accordance with drawings.
- C. Neatly fill out panelboard directories showing equipment served and location for each breaker or switch.
- D. Identify individually mounted circuit breakers with equipment controlled.

3.04 FIELD QUALITY CONTROL

- A. Perform inspection, testing, and adjusting in accordance with Section 26 0127.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA STD ATS, Section 7.6.1.1 for main circuit breakers and circuit breakers larger than 400 amperes. Tests listed as optional are not required..
- D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- E. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.05 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Measure steady-state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

3.06 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Wall plates.

1.02 RELATED REQUIREMENTS

- A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- B. Section 26 0130 - Acceptance Testing.
- C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- D. Section 26 0537 - Boxes.
- E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 0923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.
- C. IEEE C62.41.1 - IEEE Guide on Surge Environment in Low Voltage (1000V and Less) AC Power Circuits; Institute of Electrical and Electronics Engineers; 2002 (Reaffirmed 2008).
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).
- F. NEMA WD 6 - Wiring Device -- Dimensional Specifications; National Electrical Manufacturers Association; 2002 (R2008).
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- I. UL 98 - Enclosed and Dead-Front Switches; Underwriters Laboratories; 2004 (2012).
- J. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- K. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- L. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- M. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.
- N. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate wiring device ratings and configurations with electrical requirements of actual equipment to be installed.

3. Coordinate placement of outlet boxes for wall switches with actual installed door swings.
 4. Coordinate installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 5. Coordinate core drilling of holes for poke-through assemblies with work covered under other sections.
 6. Notify Architect-Engineer of conflicts or deviations from contract documents to obtain direction prior to proceeding with work.
- B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
 1. Wall Dimmers: Include de-rating information for ganged multiple devices.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Operation and Maintenance Data:
 1. Wall Dimmers: Include information on operation and setting of presets.
 2. GFI Receptacles: Include information on status indicators and testing procedures and intervals.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- C. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to authorities having jurisdiction as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cooper Wiring Devices: www.cooperwiringdevices.com.
- B. Hubbell Incorporated: www.hubbell-wiring.com.
- C. Leviton Manufacturing Company, Inc.: www.leviton.com.
- D. Lutron Electronics Company, Inc.: www.lutron.com.
- E. Pass & Seymour, a brand of Legrand North America, Inc.: www.legrand.us.
- F. Substitutions: See Section 01 6000 - Product Requirements.
- G. Source Limitations: Where possible, for each type of wiring device furnish products produced by single manufacturer and obtained from single supplier.

2.02 APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on individual branch circuit, provide receptacle with ampere rating not less than that of branch circuit.
- C. Provide weather resistant GFI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFI receptacles for receptacles installed within 6 feet of sinks.

- E. Provide GFI receptacles for receptacles serving electric drinking fountains.
- F. Unless noted otherwise, do not use combination switch/receptacle devices.

2.03 WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.
- B. Finishes:

2.04 REQUIREMENTS

- A. Wiring device colors in accordance with NEMA WD 1.
- B. Wiring device dimensions and receptacle configurations in accordance with NEMA WD 6.

2.05 WALL SWITCHES

- A. All Wall Switches: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- B. Switch Colors: Gray.
- C. Commercial Grade.
 - 1. Operation: Toggle operated in walls.
 - 2. For use on AC Systems, direct lighting control.
 - 3. Industrial specification grade.
 - 4. Quiet type.
 - 5. Wiring: Back and side.
 - 6. Rated 20 amperes, 120/277 volts AC.
 - 7. Acceptable products: CS1220 Series by Hubbell or equivalent from other acceptable manufacturers listed in Section 2.01.

2.06 WALL DIMMERS

- A. Manufacturers:
 - 1. Leviton Manufacturing Company, Inc.: www.leviton.com.
 - 2. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com.
 - 3. Pass & Seymour, a brand of Legrand North America, Inc.: www.legrand.us
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. All Wall Dimmers: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on drawings.
 - 1. Voltage: 120 volts.
 - 2. Switch Colors: White.
 - 3. Control: Linear slide with integral preset on-off switch to shut off power when lighting is not in use.
 - 4. Single point or 3-way as indicated on drawings.
 - 5. Match devices in multi-gang installations.
 - 6. Solid state circuit with integral RF interference filter. Lamp filament hum, radio and TV interference produced by dimmer is unacceptable.
 - 7. Acceptable manufacturers.
 - a. Leviton Manufacturing, Inc: www.leviton.com.
 - b. Lutron Electronics, Inc: www.lutron.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- C. Control: Slide control type with separate on/off switch.

- D. Power Rating, Unless Otherwise Indicated or Required to Control Load Indicated on Drawings:
 - 1. Fluorescent: 600 VA.
 - a. Dim lamps from full brightness to 10 percent of light output. Dimmer compatible with lamp ballast.
 - 2. LED: 150 VA.
 - a. Dim lamps from full brightness to 5 percent of light output. Dimmer compatible with lamp ballast.
- E. Provide locator light, illuminated with load off.

2.07 RECEPTACLES

- A. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- B. General Use Convenience Receptacles, for 120V, Single Phase Service.
 - 1. Color: Gray.
 - 2. Commercial grade.
 - a. Wiring: Back and side, duplex only.
 - b. 20 ampere duplex or single, as indicated on drawings.
 - 1) Configuration: NEMA 5-20R.
 - 2) Acceptable products.
 - (a) Cooper: Duplex BR20 Series, Single 1877 Series.
 - (b) Hubbell: Duplex CR5362 Series.
 - (c) Leviton: Duplex BR20 Series, Single 5801 Series.
 - (d) Pass & Seymour: Duplex BR20 Series, Single 5351 Series.
 - (e) Substitutions: See Section 01 6000 - Product Requirements.
- C. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
 - 1. Color: Brown.
 - 2. Duplex receptacle, 20 ampere, (GFCI) for 120V single phase service.
 - a. Configuration: NEMA 5-20R.
 - b. Performance standard: UL Standard 943 Class A GFCI.
 - c. Acceptable products: GFR5352A Series by Hubbell or equivalent from acceptable manufacturer listed in Section 2.01.

2.08 WALL PLATES

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell-wiring.com.
 - 2. Leviton Manufacturing Company, Inc.: www.leviton.com.
 - 3. Lutron Electronics Company, Inc.: www.lutron.com.
 - 4. Pass & Seymour, a brand of Legrand North America, Inc.: www.legrand.us
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. All Wall Plates: Comply with UL 514D.
 - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 - 2. Size: Standard.
 - 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected.
- D. Device cover plate material for office use and industrial areas.
 - 1. Offices and other finished areas: No. 302 stainless steel.

- a. Color: Match switch or receptacle.
- 2. Industrial, utility, and similar areas: Zinc or cadmium plated steel.
- 3. Damp locations/dusttight.
 - a. Weatherproof/dust tight when not in use.
 - b. Horizontal mounting.
 - c. Cast aluminum, gasketed, spring hinged cover.
- 4. Wet locations.
 - a. Weatherproof in-use.
 - b. NEMA 3R (raintight) latching, gasketless lid.
 - c. Comply with OSHA lockout/tagout requirements.
 - d. Flush style with recessed receptacles.
 - e. Frame gasket: Closed cell foam.
 - f. Horizontal mounting.
 - g. Metallic: Die cast aluminum alloy 360 with baked aluminum lacquer finish.
- 5. Screws: Identical to plate finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.
- G. Coordinate with architectural plans and wall elevations.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Perform work in neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of wiring devices provided under this section.
 - 1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - 2. Where multiple receptacles, wall switches, or wall dimmers are installed at same location and at same mounting height, gang devices together under common wall plate.
 - 3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect-Engineer to obtain direction prior to proceeding with work.
 - 4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- I. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- J. Install wall switches with OFF position down.
- K. Install wall dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.
- L. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in place of meeting this requirement.
- O. Install blank wall plates on junction boxes and on outlet boxes without wiring devices installed or designated for future use.
- P. Identify wiring devices in accordance with Section 26 0553.

3.04 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 0537 to obtain mounting heights indicated on drawings.

3.05 FIELD QUALITY CONTROL

- A. Perform field inspection, testing, and adjusting in accordance with Section 26 0130.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- D. Test each receptacle to verify operation and proper polarity.
- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.06 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect-Engineer.

3.07 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 2813

FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.

1.02 RELATED REQUIREMENTS

- A. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- B. Section 26 2818 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

- A. IEC 60947-4-1 - Low Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-Starters - Electromechanical Contactors and Motor-Starters; International Electrotechnical Commission; 2009.
- B. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2002 (R2007).
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- D. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.
- E. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.
- F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.
- G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.
- H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures; Underwriters Laboratories; Current Edition, Including All Revisions.
- I. UL 508E - Outline of Investigation for IEC Type 2 Coordination Short Circuit Tests; 2006.
- J. UL (ECMD) - Electrical Construction Materials Directory; Underwriters Laboratories; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
 - a. Fusible Enclosed Switches: See Section 26 2818.
 - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
 - 3. Notify Architect-Engineer of any conflicts with or deviations from contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide listing of manufacturer, type and size of fuses used.
- C. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
- D. Maintenance Materials: Furnish following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cooper Bussmann, a division of Cooper Industries: www.cooperindustries.com.
- B. Edison Fusegear: www.edisonfuse.com.
- C. Mersen (formerly Ferraz Shawmut): ferrazshawmut.mersen.com.
- D. Littelfuse, Inc.: www.littelfuse.com.
- E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 APPLICATIONS

- A. General Purpose Branch Circuits: Class RK1, time-delay.
- B. Individual Motor Branch Circuits: Class RK1, time-delay.
- C. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.
- D. In-Line Protection for Indoor Luminaires: Class In-Line, time-delay.
- E. Lighting Branch Circuits: Class G.

2.03 FUSES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for purpose indicated.
- B. Unless specifically indicated to be excluded, provide fuses for fusible equipment as required for a complete operating system.
- C. Provide fuses of same type, rating, and manufacturer within same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
 - 1. Class RK1, Dual Element Time-Delay Fuses:
 - a. Acceptable Products (250 Volt).
 - 1) Cooper Bussmann; Low Peak, Type LPN-RK.
 - 2) Edison Fusegear; Type LENRK.
 - 3) Littelfuse; Power Pro, Type LLNRK.
 - 4) Mersen; Amp Trap 2000, Type A2D-R.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
 - b. Acceptable Products (600 Volt).
 - 1) Cooper Bussmann; Low Peak, Type LPS-RK.
 - 2) Edison Fusegear; Type LESRK.
 - 3) Littelfuse; Power Pro, Type LLSRK.
 - 4) Mersen; Amp Trap 2000, Type A6D-R.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
- H. Class L Fuses: Comply with UL 248-10.
 - 1. Class L, Time-Delay, Current Limiting Fuses:
 - a. Acceptable Products.
 - 1) Cooper Bussmann; Low Peak, Type KRP-C.
 - 2) Edison Fusegear; Type LCL.
 - 3) Littelfuse; Power Pro, Type KLPC.
 - 4) Mersen; Amp-Trap 2000, Type A4BQ.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.

- I. Class CC Fuses: Comply with UL 248-4.
 - 1. Class CC, Time-Delay Fuses:
 - a. Acceptable Products (600 Volt).
 - 1) Cooper Bussmann; Low Peak, Type LP-CC.
 - 2) Edison Fusegear; Type EDCC
 - 3) Littlefuse; Power Pro, Type CC-MR.
 - 4) Mersen; Amp-Trap 2000, Type ATDR.
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
- J. Class G Fuses: Comply with UL 198C.
 - 1. Acceptable Products:
 - a. Cooper Bussmann; Type SC..
 - b. Edison Fusegear; Type SEC.
 - c. Littlefuse; Type SLC..
 - d. Mersen; Type AG..
 - 2. Products:
 - a. Cooper Bussmann; Type SC..
 - b. Edison Fusegear; Type SEC.
 - c. Littlefuse; Type SLC..
 - d. Mersen; Type AG..
- K. Class In-Line Fuses: Comply with UL 248-14.
 - 1. Fast Acting:
 - a. Acceptable Products:
 - 1) Cooper Bussmann; Type GLR.
 - 2) Edison Fusegear; Type GLR.
 - 3) Littlefuse; Type LGR.
 - 4) Mersen; Type SLR.
 - 2. Time-Delay:
 - a. Acceptable Products:
 - 1) Cooper Bussmann; Type GMF.
 - 2) Edison Fusegear; Type GMF.
 - 3) Littlefuse; Type LMF.
 - 4) Mersen; Type SMF.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Protect fuses from water damage before and after installation.
- C. Install fuses with label oriented such that manufacturer, type, and size are easily read.
- D. Torque fasteners to manufacturer's recommendations.
- E. Listings.
 - 1. Where fuses are used to provide short circuit protection of downstream circuit breakers, specific fuse/breaker combination must be listed as series rated in accordance with UL 489.
 - 2. Where fuses are used to provide Type 2 protection of starter, specific fuse/starter combination must be listed in accordance with UL 508E.

END OF SECTION

SECTION 26 2914
MOTOR CONTROLLERS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 26 0127 - Acceptance Inspection and Testing
- B. Section 26 2813 - Fuses.

1.02 REFERENCE STANDARDS

- A. NEMA ICS 1 - Industrial Control and Systems: General Requirements; 2000 (Ed. 2010).
- B. NEMA PB 1 - Panelboards; 2006 (2011).
- C. NFPA 70 - National Electrical Code; 2008.
- D. UL (ECMD) - Electrical Construction Materials Directory; current edition.
- E. UL 50 - Enclosures for Electrical Equipment; 2007 (2012).
- F. UL 67 - Panelboards; 2009 (2010).

1.03 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. Product data.
 - a. Motor starter panelboards.
 - b. 3 phase magnetic motor starters, full voltage combination type, individually mounted.
 - c. Single phase manual motor starters, individually mounted.
 - d. Control devices, door mounted.
 - e. Control devices, individually mounted.
 - f. Safety switches, individually mounted.
 - g. Capacitors, individually mounted.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

1.05 WARRANTY

- A. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.

1.06 MANUFACTURER'S GUARANTEE

- A. Manufacturer shall guarantee equipment to be new, undamaged, free from defects in material and Workmanship, and in compliance with Specifications and Drawings.
- B. Manufacturer's obligation shall include removing, repairing or replacing, transporting, reinstalling, and testing without charge to Owner parts damaged, defective, or not in compliance with Specifications and Drawings within 1 year from date of energization, but not more than 15 months from date of delivery of equipment to site.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Combination Motor Starters, Individually Mounted.
 - 1. Single speed, non-reversing, 3 phase motor.
 - a. Across-the-line, full voltage, combination magnetic type.
 - b. NEMA Size 1, minimum.
 - c. Designed to withstand let-through short circuit current of fuse used.
 - d. Fusible disconnect switch, contactor, and control transformer.
 - 1) Enclosure, NEMA 1 (indoor), NEMA 1 (non-industrial areas), NEMA 12 (industrial areas), and NEMA 3R (outdoor).

- 2) Disconnect switch.
 - (a) Heavy-duty type.
 - (b) Externally operable.
 - (c) Interlocked to prevent opening cover when switch is closed.
 - (d) Handle in control of switch.
 - (e) Rejection type fuse clips for dual element, current limiting fuses.
 - e. Magnetic contactor.
 - 1) 120 volt operating coil.
 - 2) Holding circuit contact plus 2 auxiliary contacts.
 - f. Overload heater elements, each phase, determine sizes for active starters.
 - g. Control transformer.
 - 1) 480 volt primary and 120 volt secondary winding.
 - 2) Fuse and ground secondary winding.
 - 3) Where remote components are energized from control transformer, increase capacity proportionately above minimum requirements of operating coil.
 - 2. Door mounted control devices.
 - 3. Acceptable manufacturers.
 - a. Eaton Corporation, Cutler-Hammer.
 - b. General Electric.
 - c. Rockwell Automation, Allen-Bradley.
 - d. Schneider Electric, Square D.
 - e. Siemens Energy and Automation.
 - f. Substitutions: See Section 01 6000 - Product Requirements.
- B. Manual Motor Starters, Single Phase, Fractional Horsepower.
- 1. Single speed for 115 volt motors.
 - a. NEMA ICS-1.
 - b. Toggle or key operated.
 - c. Single pole, quick-make, quick-break type.
 - d. 1 thermal overload element.
 - e. Pilot light.
 - f. NEMA 1 surface mounting enclosure, or with stainless steel plate for flush mounting in outlet box.
 - g. Furnish means for padlocking toggle operator in off position.
 - h. Furnish total of 4 keys for operation of key operated starters.
 - i. Overload heater elements, determine sizes for active starters.
 - 2. Acceptable products.
 - a. Bulletin 600 by Allen-Bradley.
 - b. Type MS by Cutler-Hammer.
 - c. CR101 by General Electric.
 - d. Class 2510 by Square D.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- C. Control Devices.
- 1. Push buttons and selector switches.
 - a. Heavy-duty, oiltight.
 - b. Contacts rated 10 amperes continuous, 120 volts AC.
 - c. Legend plate and inscription.
 - d. Acceptable products.
 - 1) Bulletin 800T by Allen-Bradley.
 - 2) 10250T Series by Cutler-Hammer.
 - 3) CR104P by General Electric.
 - 4) Class 52 by Siemens.
 - 5) Class 9001, Type K by Square D.
 - 6) Substitutions: See Section 01 6000 - Product Requirements.

2. Indicating lights.
 - a. Heavy-duty, oiltight.
 - b. 6 volt lamp.
 - c. Integral 120-6 volt transformer.
 - d. Push-to-test feature.
 - e. Color cap.
 - f. Legend plate and inscription.
 - g. Acceptable products.
 - 1) Bulletin 800T by Allen-Bradley.
 - 2) 10250T Series by Cutler-Hammer.
 - 3) CR104P by General Electric.
 - 4) Class 52 by Siemens.
 - 5) Class 9001, Type K by Square D.
 - 6) Substitutions: See Section 01 6000 - Product Requirements.
3. Control relays.
 - a. Heavy-duty, industrial.
 - b. Convertible contacts rated 10 amperes continuous, 300 volts AC.
 - c. 120 volts operating coil.
 - d. Number and type of contacts indicated on Contract Documents.
 - e. Acceptable products.
 - 1) Bulletin 700N by Allen-Bradley.
 - 2) AR/ARD Series by Cutler-Hammer.
 - 3) CR120B by General Electric.
 - 4) MT/46 by Siemens.
 - 5) Class 8501, Type X by Square D.
 - 6) Substitutions: See Section 01 6000 - Product Requirements.
4. Enclosures for remote mounted devices.
 - a. NEMA 12 in industrial areas.
- D. Safety Switches.
 1. Fusible or nonfusible as shown on Drawings.
 2. Quick-make, quick-break.
 3. NEMA HD heavy-duty visible blade type.
 4. Horsepower rated.
 - a. Up to 200 amperes at 600 volts.
 - b. Up to 400 amperes at 250 volts.
 5. Enclosure, NEMA 12 (industrial areas) and NEMA 3R (outdoor).
 6. 3 pole, single throw switches unless otherwise indicated.
 7. Voltage and current ratings as indicated in Contract Documents.
 8. Silver or cadmium plate contact surfaces, including fuse clips.
 9. Auxiliary control circuit contact(s) where indicated.
 - a. External operating handle connected to auxiliary contact(s) to cause contacts to open prior to main switch blades separating.
 - b. Rated at 10 amperes, 120 volts.
 10. Interlocking.
 - a. External operating handle, interlocked with cover door so cover door cannot be opened unless switch is in off position.
 - b. Means for padlocking operating handle in off position so when operating handle is padlocked in off position, cover door cannot be opened and switch cannot be closed.
 11. Fuse clips.
 - a. Standard rejection type for dual element cartridge type fuses as specified, unless otherwise required.
 12. Acceptable products.
 - a. Type H by Cutler-Hammer.

- b. Type TH by General Electric.
 - c. Type F by Siemens.
 - d. Type H by Square D.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
13. Fuses as specified in Section 26 2813.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Solid state reduced voltage controller.
 - 1. Install per manufacturer's requirements.
 - 2. Adjust feeder size to controller based on unit supplied in accordance with NEC requirements.
 - 3. Where local motor disconnect switch is indicated provide interlocking between disconnect switch and controller.
- B. Motors.
 - 1. Unless other requirements are indicated.
 - a. Motors 1/4 horsepower and larger are 460 volts, 3 phase, 60 hertz.
 - b. Motors less than 1/4 horsepower are 115 volts, single phase, 60 hertz.
 - 2. If capacity or rating of equipment being furnished in this Section is based on rating of equipment being furnished in other Sections or Contracts, confirm ratings before purchasing equipment.
- C. Control equipment.
 - 1. Install motor starters, safety switches, motor control centers, and control devices where indicated on Drawings.
 - a. Uniform heights throughout building.
 - b. Operational at convenient height, maximum 66 inches above floor.
- D. Fuses.
 - 1. Install in equipment requiring fuses.

3.02

END OF SECTION

SECTION 26 2926
VARIABLE SPEED DRIVES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 26 0127 - Acceptance Inspection and Testing.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

1.02 REFERENCE STANDARDS

- A. FCC CFR Title 47 - Telecommunication, Part 15, Subpart B.
- B. IEEE 519 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems; 1992 (2004).
- C. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives; 2006.
- D. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems; 2006.
- E. NFPA 70 - National Electrical Code; 2008.
- F. UL (ECMD) - Electrical Construction Materials Directory; current edition.
- G. UL 508 - Standard for Safety Industrial Control Equipment; 1999 (2010).
- H. UL 508C - Standard for Safety Power Conversion Equipment; 2002 (2010).

1.03 SUBMITTALS

- A. See Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Information.
 - 1. Product Data.
 - a. Drive isolation transformers, filters, reactors.
 - b. Internal diagnostic features.
 - c. Controller schematic diagrams.
 - d. Front elevation and plan view.
 - e. Type of enclosure.
 - f. Equipment weight.
 - g. Color and type of finish.
 - h. Conduit access locations.
 - i. Input power requirements.
 - 1) Volts/amperes/phase/hertz.
 - j. Output power characteristics.
 - 1) HP/Volts/amperes/phase/hertz.
 - 2. Performance Data.
 - a. At full and half load for.
 - 1) Drive efficiency (power out/power in) at 25, 50, 75, and 100 percent speed.
 - 2) Drive input power factor at 25, 50, 75, and 100 percent speed with line input power factor of 0.95.
 - 3) Variable frequency controllers.
 - 4) Isolation transformers.
 - 5) Reactors
 - 3. Manufacturer's instructions.
 - a. Installation recommendations.
 - 1) Variable frequency controllers.
 - 2) Isolation transformers
 - 3) Filters
 - 4) Reactors
- C. For Closeout.

1. Operation and Maintenance Data.
 - a. Instruction manuals shall include, but not be limited to, following.
 - 1) Index in book form of component and diagram data sheets.
 - 2) Description and assembly drawings of each item of equipment.
 - 3) Parts nomenclature.
 - 4) Wiring diagrams.
 - 5) Procedures for start-up and operation of unit.
 - 6) Instructions for disassembly and reassembly of items of equipment furnished, as required for normal operation and maintenance.
 - 7) Sequence of operation for equipment.
 - 8) Normal setpoints and limits for controls.
 - 9) Final settings and adjustments established for start-up tests.
 - 10) Troubleshooting guides.
 - 11) Recommended spare parts list.
 - b. Instruction manuals.
 - 1) 90 days prior to start-up of equipment, deliver to Owner, six copies of operating and maintenance instruction manuals bound in durable stiff covers.
 - 2) Incorporate folded insert drawings and data sheets in manuals.
 - c. Spare parts lists.
 - 1) Submit list of spare parts required to maintain units in full operation under normal operating conditions.
 - d. Maintenance service.
 - 1) Include names, address, and telephone numbers of nearest field engineering service headquarters staffed with engineers normally engaged in work specified under "Installation".

1.04 QUALITY ASSURANCE

- A. Regulatory requirements.
 1. Meet or exceed harmonic content criteria for variable frequency drives in accordance with IEEE 519.
 2. Comply with FCC rules and regulations 47 CFR, Part 15, Subpart J, regarding radio frequency interference.
 3. Electrically accepted by UL, or other qualified agency and appropriately labeled.
 - a. Have independent testing agency certify construction of equipment is in accordance with UL guidelines.
 - b. Equipment construction with UL rated components but without overall UL or comparable testing agency listing will not be acceptable.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. See Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.
- B. Deliver.
 1. To site in original unopened containers and pallets bearing manufacturer's name and brand.
 2. Affix labels to products, pallets, and containers.
 3. Delivered products and containers without complete labels may be rejected.
 4. Deliver equipment in single shipment.
 5. Protect against damage from improper handling or exposure to natural elements.
 6. Wrap equipment and components in waterproof material and box or crate.
 7. Crate fragile assemblies.
 8. Coat unpainted, exposed steel parts with protective compounds.
 9. Clearly identify shipments with.
 - a. Owner's name and address.
 - b. Contractor's Contract number or Shop Order number, as agreed upon by Contractor and Owner.

- c. Mark numbers or tag numbers to facilitate cataloging, storage, and retrieval of materials.
- d. Packing lists.
 - 1) For containers used for shipment of material, place in protective cover, attached in conspicuous location.
 - 2) Place additional list inside container.
 - 3) Clearly identify contents of each container.
- 10. Storage on site.
 - a. On level, aboveground platforms.
 - b. Keep containers dry.

1.06 MANUFACTURER'S WARRANTY

- A. Warrant furnished equipment to be new, undamaged, free from defects in material and workmanship and in accordance with Contract Documents in all respects except as modified by subsequent written agreement.
- B. Include removing, repairing or replacing, transporting, reinstalling and testing parts found damaged, defective, or nonconforming within 12 months of energization or 18 months from shipment, whichever comes first.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION AND REQUIREMENTS

- A. Furnish and install pulse width modulated (PWM), variable speed drive as defined herein. Drive shall be suitable for operation with high efficiency, alternating current induction motors rated, 3 phase, 60 hertz, B design construction at specified voltage, plus or minus 10 percent. Drive shall be contained in NEMA 1, wall mounted or floor supported enclosure.
- B. Six pulse design.
- C. Output carrier frequency of AC drive shall be programmable at 0.5, 1, 2, 4 or 8 kHz. In addition, output carrier frequency shall be randomly modulated about selected frequency and set not to exceed 4 kHz.
- D. Customer Interlock Terminal Strip: Provide separate terminal strip for connection of freeze, fire and smoke detector contacts, fault output contact, input reference signal, and external start command. External interlocks shall remain fully functional whether drive is in Hand or Auto modes. External start command shall be active when in Auto mode only.
- E. Include 5 percent line reactor at input as minimum with addition of isolation transformers and filters as required to meet this specification.
- F. Minimum efficiency at full load and full speed of:
 - 1. 89 percent for 30 hp and below.
 - 2. 96 percent for above 30 hp.
- G. Minimum power factor of 0.95 lagging at motor speed of 100 percent at full load (PF correction capacitors are not to be used with reactors/filters).
- H. Operate with momentary voltage dip below 175 VAC on 230 VAC input power and 310 VAC on 460 VAC input power for 15 milli-seconds at 85 percent full load current without any disturbances in output power delivered to load.
- I. System shall not increase motor audible noise by more than 3 dB above motor's across-the-line noise at motor speeds from 50 to 100 percent.
- J. R.F. noise, voltage spikes, and harmonics created within VSD, shall be contained within VSD and not transmitted in excess of specified limits.
- K. Automatic restart only after power outage or as required by building management system.
- L. Attempt restart minimum of three times after either single phase or total power system external fault.
- M. Capable of starting coasting load.

- N. Energy saving feature that will reduce voltage to motor when selected for variable torque loads. A constant volts/Hertz ratio to be maintained during acceleration. Output voltage will automatically adjust to meet torque requirements of load.
- O. Furnish services of factory trained personnel for work specified under heading, Installation.
- P. Operator's controls.
 - 1. Keyboard with back lit, alphanumeric operating display for programming and controlling drive.
 - a. Display messages in descriptive text, coded messages are not acceptable.
 - b. Shuttle button shall carry out navigation in menu and parameter setting.
 - c. Parameter setting shall be selectable by actual text messages and actual setting ranges.
 - d. Protection shall be selectable for each parameter. Provide password protection to avoid unauthorized tampering with parameter settings.
 - e. User shall be able to customize interface.
 - 1) Creation of user menu.
 - 2) Customization of user parameters: name, scaling, units, etc.
 - 3) Integration of bitmaps.
 - f. Programming terminal shall have simple start menu for commissioning.
 - g. Direct keypad entry to observe (Any two parameters for actual values can be selected to always be displayed.):
 - 1) Input voltage.
 - 2) Input frequency.
 - 3) Output voltage.
 - 4) Output frequency.
 - 5) DC bus voltage.
 - 6) Output power.
 - 7) Output torque.
 - 8) Output current.
 - 9) Motor speed.
 - h. Drive parameters which shall always be displayed.
 - 1) Drive status.
 - 2) Command source (terminal, keypad, etc.)
 - i. Keypad control of following.
 - 1) Run/stop.
 - 2) Local/remote selection.
 - 3) Forward or reverse (is enabled).
 - 4) Accelerate/decelerate.
 - 5) Parameter setting.
 - 6) Scrolling and viewing through actual values.
- Q. Furnish services of factory trained personnel for work specified under heading "Installation".
- R. System components, listed by UL or Engineering Testing Laboratories and in accordance with requirements of FCC Regulation 47 CFR, Part 15 and IEEE 519.

2.02 MANUFACTURERS

- A. Acceptable Manufacturers.
 - 1. ABB Group
 - 2. Eaton Corporation, Cutler-Hammer.
 - 3. General Electric Company
 - 4. Rockwell Automation, Allen-Bradley.
 - 5. Rockwell Automation, Reliance Electric.
 - 6. Schneider Electric, Square D.
 - 7. Siemens Energy and Automation, Inc.
 - 8. Substitutions: See Section 01 6000 - Product Requirements.

2.03 MANUFACTURED UNITS

A. Variable Frequency Drive Systems.

1. In addition to items defined above, each system shall include.
 - a. Adjustable frequency controller.
 - b. Power quality components: isolation transformers, filters and series reactors.
 - c. Provide output filters as required to prevent reflective voltage wave from over stressing motor windings on existing motors.
2. Adjustable frequency controller requirements.
 - a. Solid state with modular circuit boards.
 - b. Convert 480 volts, 3 phase, 60 hertz utility power to adjustable voltage and adjustable frequency AC power.
 - c. Operation on power with plus or minus 10 percent voltage and plus or minus 3 hertz.
 - d. Stepless control of motor speed.
 - e. Accept and follow external frequency reference of 4-20 mA with signal inversion.
 - f. Remote start/stop control.
 - g. Components.
 - 1) Converter for changing incoming utility alternating current to controlled voltage direct current.
 - 2) Inverter for generating alternating current of adjustable voltage and frequency for stepless control of motor speed ranging from 15 percent to 110 percent of nominal motor design speed of 1800 rpm.
 - (a) Voltage or current source.
 - (b) High speed control.
 - (c) Pulse width modulated (PWM).
 - (d) Transistorized inverters.
 - (e) Suitable for variable torque motor operation.
 - 3) Regulator, controlling converter and inverter functions, interfacing with:
 - (a) Speed commands.
 - (b) On-off commands.
 - 4) Digital Display or LED indication for.
 - (a) Power on.
 - (b) Undervoltage.
 - (c) Overvoltage.
 - (d) Overcurrent.
 - (e) Overtemperature.
 - (f) Drive failure
 - (g) On Drive
 - (h) On bypass
 - (i) Other safety limits incorporated in system.
 - 5) Digital display for.
 - (a) Motor RPM.
 - (b) Voltage output.
 - (c) Current.
 - (d) Frequency.
 - 6) Operator controls.
 - (a) Hand-Off-Automatic mode selector switch.
 - (b) Test-Isolate-Normal mode selector switch.
 - (c) Start-stop push buttons via keypad.
 - (d) Potentiometer speed control (manual mode).
 - 7) Protection for.
 - (a) Overload.
 - (b) Over and undervoltage.
 - (c) Regenerative current (negative motor rotation).

- (d) External transient and electromagnetic effects on incoming power.
 - (e) Short circuit bracing and interrupting: Refer to short circuit analysis.
- 8) Accessories.
 - (a) Input power safety disconnect.
 - (1) Flange or through door mounted circuit breaker.
 - (2) Padlockable in off position.
 - (b) Limit controls for.
 - (1) Utility power current.
 - (c) Protection from external transient and electromagnetic effects on incoming power.
 - (d) Plug-in tester card for troubleshooting purposes.
 - (e) Integral bypass capability.
 - (1) Bypass circuit shall allow user to manually bypass drive and transfer control of motor across line, running motor at full speed.
 - (2) When in inverter mode, bypass contactor is open and drive output contactor is closed. In bypass position, drive output contactor is open and bypass contactor is closed. Safety interlocks shall remain active in both inverter and bypass modes.
 - (3) Mount two position selector switch to control bypass contactor on enclosure door.
 - (4) Provide line isolation contactor to electrically isolate drive while in bypass operation without having to remove power from motor. This will allow drive to be serviced during bypass operation. Control by three position "Test-Isolate-Normal" selector switch.
 - (5) While in bypass operation, protect motor by input fuses and overload relay.
 - (6) Overload Relay: Adjustable thermal, ambient compensated with manual reset, based on motor service factor.
- 9) Enclosure.
 - (a) NEMA 1, wall mounted, floor supported or integrated into motor control center.
 - (b) Seismic requirements.
 - (1) Provide seismic ratings for wall and floor mounted enclosures.
 - (2) Compliance testing in accordance with ICC ES AC156 acceptance criteria test protocol with importance factor of 1.5.
- 3. Drive isolation transformer.
 - a. Performance matched to associated adjustable frequency controller.
 - b. Limit line disturbances and harmonic distortion within specified limits.
 - c. Furnish in separate NEMA 1 enclosure.
 - d. Limit mutual interference between VFD units.
 - e. Owner will furnish system available short circuit and X/R ratio at substation transformer and 480 volts bus feeding isolation transformer to allow proper design of isolation transformers.

PART 3 EXECUTION

3.01 INSTALLATION

A. General.

- 1. Include services of factory trained field engineer, fully familiar with installation, wiring, operation, and servicing of VSD equipment, to adequately.
 - a. Instruct installing personnel in methods of equipment.
 - b. Handling, transporting, rigging, setting and interwiring of equipment.
 - c. Perform.
 - 1) Equipment checkout.
 - 2) Equipment start-up.

- 3) Equipment testing.
- d. Instruct Owner's personnel.
 - 1) Include 1 day of instruction and training of Owner's personnel in equipment operation and maintenance.
 - 2) Include DVD instructional media when available or provide installation and operation maintenance manuals.
2. Avoid installing VSD on bus supplying power factor correction capacitors or harmonic sensitive equipment.
3. Locate VSD as close to motor as possible.
4. Where safety disconnect switch is used at motor, switch is to include early break auxiliary contact to automatically shut off VSD prior to power contacts opening.
5. Where connecting to existing motors, provide necessary output filter, if necessary, to compensate for reflective wave.
6. Install in accordance with NEC, Article 110, Requirements for Electrical Installations with special attention to Working Space and Dedicated Equipment Space.

3.02 FIELD QUALITY CONTROL

- A. Owner will furnish power and other utilities necessary to conduct tests, trial, and start of operations.

3.03 CLOSEOUT ACTIVITIES

- A. Demonstrate specified performance to satisfaction of Owner or Owner's engineers before work is turned over and accepted by Owner.

END OF SECTION

SECTION 26 4113
LIGHTNING PROTECTION FOR STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Strike (air) terminals and interconnecting conductors.
- B. Grounding and bonding for lightning protection.

1.02 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems: Electrical system grounds.
- B. Surge Protection for Wiring Systems: Specified in individual system requirements.

1.03 REFERENCE STANDARDS

- A. NFPA 780 - Standard for the Installation of Lightning Protection Systems; National Fire Protection Association; 2011.
- B. UL 96 - Lightning Protection Components; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination with Roofing Work: Ensure adequate attachment of strike terminals and conductors without damage to roofing.
- B. Pre-installation Meeting: Convene a meeting at least at least two weeks prior to commencement of any work affected by lightning protection system requirements to discuss prerequisites and coordination required by other installers; require attendance by representatives of installers whose work will be affected.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate location and layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.
 - 1. Include data on actual ground resistance determined by field measurement in accordance with NFPA 780.
 - 2. Include engineering analysis of equalization of potential to metal bodies within the structure.
- C. Product Data: Provide dimensions and materials of each component, indication of testing agency listing, and installation instructions.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Installation Certification: Submit copy of certification agency's approval.
- F. Operation and Maintenance Data: Provide recommended inspection and testing plan, including recommended intervals, to achieve periodic maintenance as recommended in NFPA 780; provide customized plan reflecting actual installation configuration with specific installed components identified.
- G. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

1.06 QUALITY ASSURANCE

- A. Maintain one copy of each referenced system design standard on site.
- B. Manufacturer Qualifications: Company specializing in lightning protection equipment with minimum three years documented experience.
- C. Designer Qualifications: Person or entity, employed by installer, who specializes in lightning protection system design with minimum three years documented experience.

- D. Installer Qualifications: Capable of providing the specified certification of the installed system.
- E. Installer Qualifications: Company specializing in lightning protection system design with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Lightning Protection Components:
 - 1. Harger Lightning and Grounding: www.harger.com.
 - 2. National Lightning Protection Corporation: www.theprotectionsource.com.
 - 3. Robbins Lightning, Inc: www.robbinlightning.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LIGHTNING PROTECTION SYSTEM

- A. Lightning Protection System: Provide complete system complying with NFPA 780, including air terminals, bonding, interconnecting conductors and grounding electrodes.
 - 1. Provide system that protects:
 - a. The entire structure.
 - b. Open air areas within 100 feet of exterior walls at grade level.
 - c. Open air areas within building footprint.
 - d. Metal communications towers (grounding only).
 - 2. Coordinate with other grounding and bonding systems specified.
 - 3. Determine ground resistance by field measurement.
 - 4. Provide copper, bronze, or stainless steel components, as applicable; no aluminum.
 - 5. Provide system certified by Underwriters Laboratories or the Lightning Protection Institute.

2.03 COMPONENTS

- A. All Components: Complying with applicable requirements of UL 96.
- B. Strike (Air) Terminals: Copper, solid, with adhesive bases for single-ply roof installations.
- C. Grounding Rods: Solid copper.
- D. Ground Plate: Copper.
- E. Conductors: Copper cable.
- F. Connectors and Splicers: Bronze.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated on shop drawings.
- B. Coordinate work with installation of roofing and exterior and interior finishes.

3.02 INSTALLATION

- A. Install in accordance with referenced system standards and as required for specified certification.
- B. Connect conductors using mechanical connectors or exothermic welding process; protect adjacent construction elements and finishes from damage.
- C. Connect conductors using mechanical connectors.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection in accordance with Section 01 4000.
- B. Perform visual inspection as specified in NFPA 780 as if this were a periodic follow-up inspection.
- C. Perform continuity testing as specified in NFPA 780 as if this were testing for periodic maintenance.

- D. Obtain the services of the specified certification agency to provide inspection and certification of the lightning protection system, including performance of any other testing required by that agency.

END OF SECTION

SECTION 26 4313

SURGE PROTECTIVE DEVICE (TVSS) FOR LOW VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 26 2316 - Panelboards

1.02 REFERENCE STANDARDS

- A. IEEE C62.34 - IEEE Standard for Performance of Low-Voltage Surge-Protective Devices (Secondary Arresters); 1996 (Reaffirmed 2001)
- B. IEEE C62.41.1- Guide on Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Reaffirmed 2008).
- C. IEEE C62.45 - Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits; 2002 (Reaffirmed 2008).
- D. NEMA LS 1 - Surge Protective Devices; 1992 (Reaffirmed 2000).
- E. NFPA 70 - National Electrical Code; 2008.
- F. NRTL - National Recognized Testing Labs are approved as "equal" for testing documentation and listing per UL Standards including: ETL.
- G. UL (ECMD) - Electrical Construction Materials Directory; current edition.
- H. UL 96 - Secondary Surge Arrester; 2005 (2010).
- I. UL 1283 - Electromagnetic Interference Filters; 2005 (2009).
- J. UL 1449 - Surge Protective Device (formerly Transient Voltage Surge Suppressors); 2010.

1.03 SUBMITTALS

- A. Refer to Section 01 3000 – Administrative Requirements, for submittal procedures.
- B. For Review.
 - 1. Shop Drawings.
 - a. Manufacturer submit electrical drawings showing wiring diagram.
 - b. Accepted by local agencies having jurisdiction.

1.04 QUALITY ASSURANCE

- A. Testing.
 - 1. Test specified system as fully assembled unit, under surge conditions with AC power applied for minimum of 1 hour.
 - 2. Include quality control checks, dielectric voltage withstand test in accordance with UL requirements, UL ground continuity tests, and operational and calibration tests.
- B. Environmental Requirements.
 - 1. Storage temperature: Minus 67 to plus 187 degrees F.
 - 2. Operating temperature: Minus 40 to plus 140 degrees F.
 - 3. Relative humidity: 0 to 95 percent.
 - 4. Audible noise: Less than 45 dBa at 5 feet.
 - 5. Operating altitude: 0 to 18,000 feet above sea level.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 01 6000 – Product Requirements, for transportation, storage, and handling requirements.

1.06 WARRANTY

- A. Refer to Section 01 7800 – Closeout Submittals, for additional warranty requirements.
- B. Manufacturer's SPD Warranty.
 - 1. Full 5-year unlimited parts and on-site labor for service entrance, distribution, and branch panels.

2. Warranty from date of shipment against any part failure when installed in compliance with.
 - a. Manufacturer's instructions.
 - b. UL listed requirements.
 - c. Applicable national, state, and local electrical codes.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Design Requirements.
 1. UL listed and labeled under UL 1283 and UL 1449.
 2. Permanently affix surge ratings to surge protective device system (SPD).
- B. Electrical Power Monitoring.
 1. Coordinate requirements of this section with Section 26 0913 - Electrical Power Management System by supplying appropriate features for equipment specified herein.
 - a. Provide connectivity to interface with Electrical Power Management System described in Section 26 0913.
 - b. Include hardware, internal wiring, and programming required to connect to remote monitoring and control system.
 - c. See Section 26 0913 for parameters to be monitored.
- C. Performance Requirements.
 1. Provide high energy surge current diversion, suitable for application in IEEE C62.41 Category A, B, and C3 environments, as tested by IEEE C62.11 and C62.45.
- D. Electrical Requirements.
 1. Nominal system operating voltages as indicated on drawings.
 - a. 480/277 wye, 3 phase, 4 wire, plus ground.
 2. Maximum continuous operating voltage: Greater than 115 percent of nominal system operating voltage to ensure ability of system to withstand temporary RMS overvoltage.
 3. Operating frequency range: At least 47 to 63 hertz.
- E. Life Cycle Testing.
 1. Duty life cycle test to survive minimum of 3000 surges per mode of 20 kV, 10 kA, IEEE C62.41 Category C3 surge current with less than 10 percent degradation of clamping voltage.
 2. For valid test, specified overcurrent protective devices must be installed and intact in surge current path.
- F. Safety, Overcurrent Protection (Fusing).
 1. Manufacturer shall submit test data from nationally recognized laboratory, ensuring.
 - a. When SPD suppression components are installed at location specified, components shall be proven to fail without protected load interruption, in safe nonviolent manner (without smoke, fire, flame, case or module distortion, emission of molten particles or other physical damage).
 - b. Fusing shall be specifically designed and tested to provide full surge current capability.
 - c. Failure is defined and inclusive of bolted short and high impedance (ground faulted) conditions within the suppressor.
 2. If overcurrent protection devices (OPD) are utilized to obtain fail-safe condition, submit certified test from nationally recognized testing laboratory to indicate.
 - a. OPD and suppression components I-squared-T capacity is capable of conducting specified transient current without operation.
 - b. Capable of clearing both high and low impedance fault conditions (in specified suppression modes) while protecting the SPD against violent failure as defined above.
 - c. Protect each individual current diversion component.
 - d. Monitored to provide internal and remote indication of suppression failure/operability.

- e. KAIC ratings of commercially available OPDs alone or UL 1449 product listing shall not constitute validity without nationally recognized laboratory test as outlined above.
 - f. Architect-Engineer requires submittal documentation of compliance for approval.
- G. Design Requirements.
- 1. Protection modes.
 - a. All modes, Line to neutral, line to line, line to ground, and neutral to ground (where applicable).
 - 2. Clamping voltage: In accordance with UL 1449 ratings, for specified protection modes shall not exceed following in any mode of protection.
 - a. 120/208 volt.
 - 1) Without disconnect: 400 volts.
 - 2) With disconnect: 500 volts.
 - b. 277/480 volt.
 - 1) Without disconnect: 800 volts.
 - 2) With disconnect: 1000 volts.
 - c. 480 volt.
 - 1) Without disconnect: 1500 volts.
 - 2) With disconnect: 1500 volts.
 - 3. Noise attenuation.
 - a. UL 1283 listed as electromagnetic interference filter.
 - b. Filter to provide insertion loss with minimum of 50 dB from 100 KHz to 100 MHz per 50 Ohm Insertion Loss Methodology from MIL 220A.
 - c. System to provide up to 120 dB insertion loss from 100 KHz to 100 MHz when used in coordinated facility system where SPD's are integral to equipment protected.
- H. Performance Ratings.
- 1. Minimum SPD surge current capacity in accordance with NEMA LS-1, with fusing in place.
 - a. Service entrance equipment.
 - 1) Line to neutral mode: 150 kA.
 - 2) Line to ground mode: 150 kA.
 - 3) Neutral to ground mode: 150 kA.
 - 4) Each array shall be capable of withstanding over 5000 pulses of 20kV, 10kA IEEE C62.45 Category C surge currents without failure when tested in accordance with C61.11, C62.45 at one minute intervals.
 - 5) Surge current diversion components will be selenium enhanced metal oxide varistors (MOV).
 - b. Distribution panels.
 - 1) Line to neutral mode: 100 kA.
 - 2) Line to ground mode: 100 kA.
 - 3) Neutral to ground mode: 100 kA.
 - 4) Each array shall be capable of withstanding over 4500 pulses of 20kV, 10kA IEEE C62.45 Category C surge currents without failure when tested in accordance with C61.11, C62.45 at one minute intervals.
 - 5) Surge current diversion components will be metal oxide varistors (MOV).
 - c. Branch panels.
 - 1) Line to neutral mode: 50 kA.
 - 2) Line to ground mode: 50 kA.
 - 3) Neutral to ground mode: 50 kA.
 - 4) Each array shall be capable of withstanding over 3000 pulses of 20kV, 10kA IEEE C62.45 Category C surge currents without failure when tested in accordance with C61.11, C62.45 at one minute intervals.
 - 5) Surge current diversion components will be metal oxide varistors (MOV).

2.02 MANUFACTURERS

- A. Surge Protective Device System.

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SURGE PROTECTIVE DEVICE (TVSS) FOR LOW
VOLTAGE ELECTRICAL POWER CIRCUITS

ALBERT KAHN ASSOCIATES, INC.

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1. Current Technology Division of Danaher Power Solutions.
2. Cutler Hammer.
3. General Electric.
4. Innovative Technology.
5. Square D.
6. Substitutions: Not permitted.

2.03 EQUIPMENT

- A. Dual Listed UL 1449 and UL 96.
- B. SPD enclosure (mounted external or internal to equipment).
 1. Heavy-duty NEMA 4/12 dusttight, driptight, with no ventilation openings.
 2. Monitoring indication visible without open door.
- C. Connections to system.
 1. External disconnect to SPS to facilitate testing, maintenance and replacement.
 2. Circuit breaker located in equipment protected or externally mounted safety disconnect switch.
 3. Fault current rating commensurate with available system fault current.
 4. Methodology and/or wire gauge to be specified by SPD manufacturer.
- D. Internal Connections and Serviceability.
 1. Connect surge current diversion components by way of low impedance connections.
 2. System designed for simple change out of SPD component by qualified electrician. Designs requiring factory service are not acceptable.
 3. Connections, conductors, and terminations: Size appropriately in accordance with National Electrical Code for specified surge current capacity.
- E. Surge Suppression Components.
 1. Individually fused MOV's matched to within 1 percent variance.
 2. Each array shall be capable of withstanding over 3000 pulses of 20 kV, 10 kA IEEE C62.41 Category C surge currents without failure when tested in accordance with C61.11, C62.45, suggested wait times.
 3. Arrays designed and constructed to ensure equivalent MOV surge current sharing.
 4. Use of gas tubes or silicon avalanche diodes are not acceptable.
 5. Protection modes, including neutral to ground, shall be monitored and internally fused, for compliance to NFPA 70 articles 110.9, 110.10 and 280.22.
- F. Component Testing and Monitoring.
 1. Unit self-monitors surge suppression components in all protective modes, in all phases, including neutral to ground, where applicable.
 2. Form "C" dry contacts for connection to remote monitoring system for summary alarm.
 3. Units requiring external test sets or equipment are unacceptable.
 4. Display and Alarm System (continuously monitor and annunciate).
 - a. Battery powered audible alarm that detects and notifies single and multiple phase failure of suppression filter system. Provide alarm with silence switch, test switch, and alarm LED that illuminates when alarm is disabled. Provide easily replaceable and easily obtainable battery. Include LED battery replacement indicator.
 - b. Status of hybrid elements including: selenium, MOV's, and filter capacitors in all phases.
 - c. Event counter to indicate cumulative number of transients unit was subjected to. Detection circuitry must be current sensing to eliminate erroneous counts due to stray voltages and noise, both conducted and radiated.
 - d. Neutral-to-ground fault (wye systems).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install.

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SURGE PROTECTIVE DEVICE (TVSS) FOR LOW
VOLTAGE ELECTRICAL POWER CIRCUITS

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1. Parallel SPD with short and straight conductors.
2. Twist SPD input conductors together to reduce input conductor inductance.
3. Follow manufacturer's recommended practices for installation, operation, and maintenance.
4. Where breaker is used to disconnect SPD minimum size.
 - a. Service entrance: 100A.
 - b. Distribution panel: 60A
 - c. Receptacle panel: 30A
5. Installation to comply with applicable codes.
6. Installing SPD within equipment is not permitted.
7. Installation is not complete until integrity of electrical system ground at point of SPD termination is verified.

END OF SECTION

SECTION 26 5100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Ballasts and drivers.
- E. Fluorescent emergency power supply units.
- F. Lamps.
- G. Luminaire accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 0130 - Acceptance Testing.
- B. Section 26 0537 - Boxes.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 0918 - Remote Control Switching Devices: Remote controls for lighting, including network lighting controls, programmable relay panels, and remote control switching relays.
- E. Section 26 0919 - Enclosed Contactors: Lighting contactors.
- F. Section 26 5600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.
- B. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).
- C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- E. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.
- F. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.
- G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; National Electrical Manufacturers Association; 2011.
- H. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2012.
- I. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- J. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2009.
- K. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
- L. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- M. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.
- N. UL 1598 - Luminaires; Current Edition, Including All Revisions.

- O. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination.
 - 1. Coordinate installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate work with placement of supports, anchors, etc., required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 3. Coordinate placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
 - 4. Notify Architect-Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings.
 - 1. Prior to shop drawing submittal.
 - a. Verify ceiling types on architectural reflected ceiling plans for proper installation of trims.
 - b. Verify wall switching and controls on drawings for proper types of options required on fixtures.
 - 2. Indicate dimensions and components for each luminaire.
 - 3. Interior light fixture shop drawings must be submitted at one time.
 - 4. Provide photometric calculations where luminaires are proposed for substitution upon request.
 - 5. Substitutions of light fixtures that are not listed in fixture schedule shall be rejected. Any light fixture substitutions required, shall be preapproved before bid as indicated in fixture schedule.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, ceiling compatibility, and installed accessories; include model number nomenclature clearly marked with all proposed features. Provide manufacturer's standard catalog pages and data sheets, including detailed information on lamps and ballasts.
 - 1. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.
 - 2. Submit fixture shop drawings in booklet form with separate sheet(s) for each fixture, assembled per "luminaire type" in fixture schedule order, with proposed fixture and accessories clearly indicated on each sheet. Light fixture cut sheets shall include as a minimum, fixture efficiency as specified, mounting, lamp quantity, reflector, diffuser, lens trim type, wiring diagrams, list of compatible lamp configurations, and all options and accessories. Shop drawings clearly indicate which options are provided with each fixture.
 - 3. For each fixture requiring a ballast or driver, provide separate ballast cut sheets for each type of ballast provided shall be submitted with lighting fixture booklets. Ballast cut sheets shall include as a minimum, input wattage, wiring diagrams, Total Harmonic Distortion (THD), Ballast Factor (BF), and Power Factor (PF). Shop drawings shall clearly indicate which ballast type is provided with each fixture.
 - 4. Separate lamp cut sheets for each type of lamp provided shall be submitted with lighting fixture booklets. Lamp cut sheets shall include as a minimum, color temperature, Color

- Rendering Index (CRI), rated life, initial and mean lumen output. Shop drawings clearly indicate which lamp type is provided with each fixture.
5. Fluorescent Emergency Power Supply Unit: Include list of compatible lamp configurations and associated lumen output.
 6. Air Handling Luminaires: Include air handling performance data.
- D. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.
 - E. Field Quality Control Reports.
 - F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
 - G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
 - H. Maintenance Materials: Furnish following for Owner's use in maintenance of project.
 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - I. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70 and NFPA 101.
- B. Products: Listed and classified by Underwriter's Laboratories Inc. (UL) as suitable for purpose specified and indicated.
- C. Maintain at project site copy of each referenced document that prescribes execution requirements.
- D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide two year manufacturer warranty for all linear fluorescent ballasts.
- C. Provide five year pro-rata warranty for batteries for emergency lighting units.
- D. Provide ten year pro-rata warranty for batteries for self-powered exit signs.
- E. Provide three year full warranty for fluorescent emergency power supply units.

PART 2 PRODUCTS

2.01 LUMINAIRES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Section 01 6000 - Product Requirements, except where individual luminaire types are designated with substitutions not permitted.

2.02 LUMINAIRE REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.

- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.
- D. Provide products complying with Federal Energy Management Program (FEMP) requirements.
- E. Unless otherwise indicated, provide complete luminaires including lamp(s) or tube(s), and sockets, ballasts, reflectors, lenses, fuses, supports, brackets, canopies, globes, housings and other components required to position, energize, operate, and protect lamp and distribute light.
- F. Unless specifically indicated to be excluded, provide required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for complete operating system.
- G. Provide products suitable to withstand normal handling, installation, and service without damage, distortion, corrosion, fading, discoloring, etc.
- H. Provide luminaires with metal parts that are free of burrs, sharp corners, and edges.
- I. Doors and frames shall prevent accidental falling during relamping or ballast replacement.
- J. Furnish Fuse Protection for fluorescent and H.I.D. Fixtures.
 - 1. On line side of ballasts to protect ballast and lamps.
 - 2. Shall not open unnecessarily within range of plus or minus 10 percent of rated voltage of luminaire.
- K. Units for Unheated Areas.
 - 1. Furnish low temperature ballasts with minus 29 degrees C (minus 20 degrees F) rating minimum for fluorescent.
 - 2. Self-igniting HPS lamps, in accordance with lamp specifications.
- L. Exposed Hardware: Stainless steel.
- M. Recessed Mounted Luminaires.
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
 - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
 - 4. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.
 - a. Luminaires for Air Supply/Return: Provide air control blades where indicated.
 - b. Luminaires for Heat Removal: Provide heat removal dampers where indicated.
 - 5. Troffers.
 - a. In metal pan and lay-in type ceilings.
 - 1) Same dimensions as tiles they replace.
 - 2) Grid frames with no flanges.
 - 3) Clips identified for use with tee-bar ceiling framing.
 - b. In drywall or other types of ceilings, flanges covering joints between fixtures and ceiling.
 - c. In plaster ceilings, furnish suitable plaster frames.
 - d. Design for individual or continuous mounting in ceiling.
 - e. Adjustable wing type hangers.
 - 6. Downlights.
 - a. In lay-in type ceilings,
 - 1) Locate at quarter or half points of tile.
 - 2) Flanges covering joints between fixtures and ceiling.
 - b. In other types of ceilings, flanges covering joints between fixtures and ceiling.
 - c. In plaster ceilings, furnish suitable plaster frames.
- N. Surface Mounted Luminaires:
 - 1. Fixture body and door frame painted after fabrication.

2. White powder coat paint finish, 1.4 to 1.7 mil thick with minimum reflection factor of 89 percent.
 3. Design door frames and lens/louver assemblies to allow complete removal for cleaning.
 4. Gasketing or construction to prevent light leaks around trim and doors.
 5. Corrosion-resistant finish for door latch.
- O. Suspended Mounted Luminaires.
1. Furnish swivel hangers for pendant luminaires.
 2. Furnish pendant length required to suspend luminaire at indicated height.
- P. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for classification of installed location.
- Q. Fluorescent Luminaires.
1. Provide ballast disconnecting means complying with NFPA 70 where required.
 2. Fluorescent Luminaires Controlled by Occupancy Sensors: Provide programmed start or programmed rapid start ballasts.
 3. Fluorescent Luminaires Controlled by Dual-Level Switching: Provide with two ballasts.
 - a. Luminaires with Two Lamps: Each ballast controls one lamp.
 - b. Luminaires with Three Lamps: One ballast controls two outer lamps and one ballast controls inner lamp.
 - c. Luminaires with Four Lamps: One ballast controls two outer lamps and one ballast controls two inner lamps.
 4. Fluorescent Luminaires Controlled by Bi-Level Switching: Provide with stepped-dimming ballast, multi-stepped-dimming ballast, full range dimming ballast, or as indicated on plans.
 - a. Luminaires with Two, Three, or Four Lamps: Each ballast controls one or two lamps.
 5. Surface-mounted.
 - a. Minimum 22 gauge electroplated, zinc coated steel, bonderized for paint adhesion and rust prevention.
 - b. Fixture body and door frame painted after fabrication.
 - c. Baked-on white enamel paint finish, 1.4 to 1.7 mil thick with minimum reflection factor of 89 percent.
 - d. Design door frames and lens/louver assemblies to allow complete removal for cleaning.
 - e. Gasketing or construction to prevent light leaks around trim and doors.
 - f. Corrosion-resistant finish for door latch.
 6. Recessed.
 - a. In ceilings, same dimensions as tiles they replace.
 - b. In metal pan and lay-in type ceilings, no flanges.
 - c. In other types of ceilings, flanges covering joints between fixtures and ceiling.
 - d. In plaster ceilings, furnish suitable plaster frames.
 - e. Design for individual or continuous mounting in ceiling.
 - f. Adjustable wing type hangers.
 - g. Clips identified for use with tee-bar ceiling framing.
 - h. Provide grid frames for recessed luminaires located in metal pan and lay-in ceilings.
 - i. Provide flanges for recessed luminaires located in drywall or other types of ceilings.
 - j. Provide plaster frames for recessed luminaires located in plaster ceilings.
- R. LED Luminaire Components: UL 8750 recognized or listed as applicable.
- S. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.
- T. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EMERGENCY LIGHTING UNITS

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Description: Emergency lighting units complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
- C. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- D. Battery.
 - 1. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- F. Provide low-voltage disconnect to prevent battery damage from deep discharge.
- G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- H. Where indicated, provide units with integral time delay to maintain emergency illumination for 15 minutes after restoration of normal power source.
- I. Accessories.
 - 1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
 - 2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
 - 3. Provide compatible accessory wire guards where indicated.
 - 4. Where indicated, provide emergency remote heads that are compatible with emergency lighting unit they are connected to and suitable for installed location.

2.04 EXIT SIGNS

- A. Furnish products as indicated in luminaire schedule included on drawings.
- B. Description: Exit signs and similar signs for special purpose applications such as area of refuge/rescue assistance.
- C. Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
 - 1. Number of Faces: Single or double as indicated or as required for installed location.
 - 2. Directional Arrows: As indicated or as required for installed location.
- D. Self-Powered Exit Signs.
 - 1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
 - 2. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
 - 3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
 - 4. Provide low-voltage disconnect to prevent battery damage from deep discharge.
 - 5. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- E. Accessories.
 - 1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
 - 2. Provide compatible accessory wire guards where indicated.

2.05 BALLASTS, GENERATORS, DRIVERS, AND CONTROL UNITS

- A. Furnish products as indicated in luminaire schedule included on drawings.
- B. Manufacturers.
 - 1. General Electric Company/GE Lighting: www.gelighting.com.
 - 2. Osram Sylvania: www.sylvania.com.
 - 3. Philips Lighting Electronics/Advance: www.advance.philips.com.
 - 4. Universal Lighting Technologies: <http://unvlt.com>.
 - 5. Substitutions: Luminaire Manufacturer's Equivalent Ballast.
 - 6. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by single manufacturer.
 - 7. Where specific manufacturer or model is indicated elsewhere in luminaire schedule or on drawings, substitutions are not permitted unless explicitly indicated.
- C. General Requirements.
 - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
 - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
 - 3. Certify ballast design and construction by Certified Ballast Manufacturers, Inc.
 - 4. Shall be Reduction of Hazardous Substances (RoHS) compliant.
www.rohs.eu/english/index.html.
 - 5. Underwriters Laboratories (UL935), Class P, Type 1 Outdoor or Type 2 Indoor listed.
- D. Electronic Fluorescent Ballasts.
 - 1. Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11, listed and labeled as complying with UL 935.
 - a. Inrush Current: Not exceeding peak currents specified in NEMA 410.
 - b. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
 - c. Single or Multi-voltage sensing.
 - d. Total Harmonic Distortion: Not greater than 10 percent.
 - e. Power Factor: Not less than 0.98.
 - f. Ballast Factor: Normal ballast factor between 0.87 and 0.89, unless otherwise indicated.
 - g. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
 - h. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
 - i. Lamp Compatibility: Specifically designed for use with specified lamp, without visible flicker.
 - j. Lamp Operating Frequency: Greater than 40 kHz.
 - 1) Do not operate lamp(s) within frequencies from 30 kHz through 40 kHz in order to avoid interference with infrared devices.
 - k. Lamp Current Crest Factor: Not greater than 1.7.
 - l. Lamp Wiring Method.
 - 1) Instant Start Ballasts: Parallel wired.
 - 2) Rapid Start Ballasts: Series wired.
 - 3) Programmed Start Ballasts: Provide parallel or series/parallel wired where available; otherwise series wired is acceptable.
 - m. Lamp Starting Method Characteristics.
 - 1) Instant Start Ballasts.
 - (a) Designed for 10,000 to 15,000 starts.
 - (b) High initial voltage of 600 volts to start lamp.
 - (c) Provide Independent Lamp Operation (ILO) to allow remaining lamps to maintain full light output when one or more lamps fail.
 - 2) Rapid Start Ballasts.
 - (a) Designed for 15,000 to 20,000 starts.

- (b) Initial voltage of 500 volts to start lamp.
 - 3) Programmed Start Ballasts.
 - (a) Designed for use with occupancy sensors by providing 50,000 starts minimum.
 - (b) Precise cathode heating to 700 degrees C prior to lamp ignition.
 - (c) Provide Independent Lamp Operation (ILO) to allow remaining lamps to maintain full light output when one or more lamps fail.
- n. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of 0 degrees F, and energy saving lamp(s) at minimum of 60 degrees F unless otherwise indicated.
- o. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
- p. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.
- q. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location Category A.
- r. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.
- s. Provide high efficiency T8 lamp ballasts certified as NEMA premium where indicated.
- t. Provide lamp striation reduction circuitry.
- u. Ballast Marking: Include wiring diagrams with lamp connections.
- 2. Nondimming Fluorescent Ballasts.
 - a. Lamp Starting Method.
 - 1) T8 Lamp Ballasts: Programmed start unless otherwise indicated.
 - (a) Minimum ballast factor (BF) for primary lamp application of:
 - (1) 0.77-0.78 for low wattage.
 - (2) 0.87-0.89 for normal light output.
 - (3) 1.15-1.20 for high light output.
 - (b) Acceptable products.
 - (1) Advance Transformer: Optanium 2.0.
 - (2) General Electric: UltraStart.
 - (3) Osram Sylvania: QuickTronic.
 - (4) Universal: AccuStart.
 - (5) Substitutions: Luminaire Manufacturer's Equivalent Ballast.
 - 2) T5 Lamp Ballasts: Programmed start unless otherwise indicated.
 - (a) Minimum ballast factor (BF) for primary lamp application of:
 - (1) 0.77-0.78 for low wattage.
 - (2) 0.87-0.89 for normal light output.
 - (3) 1.15-1.20 for high light output.
 - (b) Contain hi-low switching option when operating four F54T5/HO lamps to allow switching from 4-2 lamps, 3-2 lamps, or 3-1 lamps.
 - (c) Acceptable products.
 - (1) Advance Transformer: Centium.
 - (2) General Electric: UltraStart.
 - (3) Osram Sylvania: QuickTronic.
 - (4) Universal: AccuStart.
 - (5) Substitutions: Luminaire Manufacturer's Equivalent Ballast.
 - 3) Compact Fluorescent Lamp Ballasts: Programmed start unless otherwise indicated.
 - (a) Minimum ballast factor (BF) of 0.95 for primary lamp application.
 - (b) Four-pin lamp base wherever possible.
 - (c) Acceptable products.
 - (1) Advance Transformer: SmartMate.

- (2) General Electric: C series.
 - (3) Osram Sylvania: QuickTronic.
 - (4) Universal: MicroStar.
 - (5) Substitutions: Luminaire Manufacturer's Equivalent Ballast.
 - b. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of 0 degrees F, and energy saving lamp(s) at a minimum of 60 degrees F unless otherwise indicated.
- 3. Dimming Fluorescent Ballasts.
 - a. Control Scheme.
 - 1) Four-wire low voltage (0-10V).
 - (a) Minimum ballast factor (BF) of 1.00 at maximum light output and 0.03 at minimum light output for primary lamp application.
 - (b) Control lamp relative light output from.
 - (1) 100 percent to Three percent for T8 and CFL lamps.
 - (2) 100 percent to One percent for T5/HO lamps.
 - (c) Controlled by a compatible 4-wire, Class 1 or Class 2 low voltage 0-10 VDC controller.
 - (d) Integral protection circuitry to withstand connection of low voltage control leads to mains power supply. Ballast shall default to maximum light output in this event.
 - (e) Acceptable products.
 - (1) Advance Transformer: Mark 7.
 - (2) General Electric: UltraStart.
 - (3) Lutron: TVE.
 - (4) Osram Sylvania: QuickTronic.
 - (5) Universal: AccuStart.
 - b. Full lumen output of lamps.
 - 4. Bi-Level Stepped Dimming Linear Fluorescent Ballasts.
 - a. Bi-Level Operation: Capable of being switched between full light output on all lamps, 50 percent of full light output on all lamps, and all lamps off.
 - b. Control Compatibility: Capable of being controlled by standard manual light switches or occupancy sensors unless otherwise indicated.
 - c. Lamp Starting Method: Programmed start unless otherwise indicated.
 - 1) T8 Lamp Ballasts: Programmed start unless otherwise indicated.
 - (a) Minimum ballast factor (BF) for primary lamp application of:
 - (1) 0.95 for 100 percent power (Full Light Output) and 0.35 for 50 percent power (Bi-Level Mode).
 - (2) 1.15 for 100 percent power (Full Light Output) and 0.48 for 50 percent power (Bi-Level Mode).
 - (b) Acceptable products
 - (1) General Electric: UltraMax.
 - (2) Osram Sylvania: QuickTronic/QuickStep.
 - (3) Universal: BallaSTAR.
 - (4) Substitutions: Luminaire Manufacturer's Equivalent Ballast.
 - 2) T5 Lamp Ballasts: Programmed start unless otherwise indicated.
 - (a) Minimum ballast factor (BF) for primary lamp application of:
 - (1) 0.95 for 100 percent power (Full Light Output) and 0.35 for 50 percent power (Bi-Level Mode).
 - (2) 1.15 for 100 percent power (Full Light Output) and 0.48 for 50 percent power (Bi-Level Mode).
 - (b) Acceptable products.
 - (1) Advance Transformer: Optanium.
 - (2) Osram Sylvania: QuickTronic/QuickStep.
 - (3) Universal: BallaSTAR.

- (4) Substitutions: Luminaire Manufacturer's Equivalent Ballast.
- d. Lamp Starting Temperature: Capable of starting lamp(s) at minimum of 50 degrees Fahrenheit.
- E. Electronic Light Emitting Diode (LED) Drivers: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
 - 1. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
 - 2. Total Harmonic Distortion: Not greater than 20 percent.
 - 3. Power Factor: Not less than 0.90.
 - 4. Dimming Range: Continuous dimming from 100 percent to one percent relative light output, without flicker and with even tracking across multiple lamps.
 - 5. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
 - 6. Lamp Operating Frequency: Greater than 60 hertz or higher.
 - 7. Lamp Current Crest Factor: Not greater than 1.5.
 - 8. Lamp Starting Temperature: Capable of starting standard lamp(s) at minimum of minus 40 degrees Fahrenheit.
 - 9. Driver efficiency: Not less than 85 percent.
 - 10. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
 - 11. Designed for use with occupancy sensors by providing 50,000 starts minimum.
 - 12. Provide End-of-Life (EOL) automatic shut down circuitry.
 - 13. Surge Tolerance: Capable of withstanding 250 repetitive strikes of "C Low" (C Low – 6kV/1.2 x 50 μ s, 10kA/8 x 20 μ s) waveforms at 1 minute intervals with less than 10 percent degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2, location category A.
 - 14. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.
 - 15. Acceptable products.
 - a. Advance Transformer: Xitanium.
 - b. Osram Sylvania: Optotronic.
 - c. Substitutions: Luminaire Manufacturer's Equivalent Ballast.

2.06 FLUORESCENT EMERGENCY POWER SUPPLY UNITS

- A. Furnish products as indicated in luminaire schedule included on drawings.
- B. Manufacturers.
 - 1. Iota Engineering, LLC: www.iotaengineering.com.
 - 2. Lithonia Lighting: www.lithonia.com.
 - 3. Philips Emergency Lighting/Bodine: www.bodine.com.
 - 4. Substitutions: Luminaire Manufacturer's Equivalent Ballast.
 - 5. Manufacturer Limitations: Where possible, for each type of luminaire provide fluorescent emergency power supply units produced by a single manufacturer.
 - 6. Where specific manufacturer or model is indicated elsewhere in luminaire schedule or on drawings, substitutions are not permitted unless explicitly indicated.
- C. Description: Self-contained fluorescent emergency power supply units suitable for use with indicated luminaires.
- D. Conform To.
 - 1. NFPA 101, Life Safety Code and applicable state and local codes.
 - 2. Listed and labeled as complying with UL 924, Emergency Lighting and Power Equipment.
 - 3. NEC and OSHA illumination Requirements.
 - 4. Metallic or polycarbonate housing: Flame rating of 0 in accordance with UL 94V.
- E. Compatibility.

1. Ballasts: Compatible with electronic, standard magnetic, energy saving, dimming AC ballasts including instant start, rapid start, program start, and those with end of lamp life shutdown circuits.
 2. Lamps: Compatible with low-mercury lamps.
- F. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to fluorescent emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source unless noted otherwise.
- G. Operating voltage: Dual input 120/277.
- H. Battery.
1. Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated.
 2. Three year shelf life, 7 to 9 year expected life at rated operating temperature.
- I. Charger:
1. Electronic, constant current or constant series resistor.
 2. Capacitive input circuit.
 3. High efficiency push-pull inverter.
 4. Fully recharges within 24 hours.
- J. Mounting and Output.
1. Fluorescent linear and compact, channel mounted, normal output.
 - a. General.
 - 1) Factory wired for UL listed assembly.
 - 2) Field wiring will be allowed.
 - b. Performance.
 - 1) One-lamp operation (1 to 4 lamp ballasts), or 2-lamp operation (2 to 4 lamp ballasts).
 - 2) Minimum initial output of 600 to 700 lumens depending on lamp type.
 - 3) Minimum output approximately 450 lumens over 90 minute duration (based on one 40 watt, T12 lamp with energy saving rapid start ballast).
 - c. Lamp types.
 - 1) U-lamp, T8.
 - 2) Linear, 24 inches to 96 inches, T8 or T8HO.
 - 3) Linear, 24 inches to 48 inches, T5 or T5HO.
 - 4) Long twin tube (4-pin).
 - d. Acceptable manufacturers (verify compatibility with ballast/lamp used).
 - 1) Bodine, B70A Series.
 - 2) Chloride, C700A Series.
 - 3) Cornerstone/Hubbell, EFP3 Series.
 - 4) Dual-Lite, UFO-5W Series.
 - 5) Emergi-Lite, FPSU-28 Series (Thomas & Betts Corporation).
 - 6) Lightalarms, AM9 Series (Thomas & Betts Corporation).
 - 7) Lithonia, PS600 Series.
 - 8) Side-Lites, S45F Series.
 - 9) Sure-Lite, FBP240U Series.
 - 10) Substitutions: See Section 01 6000 - Product Requirements.
 2. Fluorescent linear and compact, channel mounted, high output.
 - a. General.
 - 1) Factory wired for UL listed assembly.
 - 2) Field wiring will be allowed.
 - b. Performance.
 - 1) One-lamp operation (1 to 4 lamp ballasts), or 2-lamp operation (2 to 4 lamp ballasts).
 - 2) Minimum initial output of 1100 to 1400 lumens depending on lamp type.

- 3) Minimum output approximately 1050 lumens over 90 minute duration (based on one 32 watt, T8 lamp with energy saving rapid start ballast).
- c. Lamp types.
 - 1) U-lamp, T8.
 - 2) Linear, 24 inches to 96 inches, T8 or T8HO.
 - 3) Linear, 24 inches to 48 inches, T5 or T5HO.
 - 4) Long twin tube (4-pin).
 - 5) Quad tube (4-pin).
 - 6) Triple tube (4-pin).
- d. Acceptable manufacturers (verify compatibility with ballast/lamp used).
 - 1) Bodine, B50 Series.
 - 2) Chloride, C1400 Series.
 - 3) Cornerstone/Hubbell, EFP5 Series.
 - 4) Dual-Lite, UFO-6W Series.
 - 5) Emergi-Lite, FPS1/U Series (Thomas & Betts Corporation).
 - 6) Lightalarms, AM10 Series (Thomas & Betts Corporation).
 - 7) Lithonia, PS1400 Series.
 - 8) Side-Lites, S60F Series.
 - 9) Sure-Lite, FBP240H Series.
 - 10) Substitutions: See Section 01 6000 - Product Requirements.
- K. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.
- L. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status and field selectable audible alert.
- M. Operating Temperature: From 32 degrees F to 122 degrees F unless otherwise indicated or required for installed location.
- N. Accessories.
 1. Provide compatible accessory remote combination test switch/indicator light.

2.07 LAMPS

- A. Furnish products as indicated in luminaire schedule included on drawings.
- B. Manufacturers.
 1. General Electric Company/GE Lighting: www.gelighting.com.
 2. Osram Sylvania: www.sylvania.com.
 3. Philips Lighting Company: www.lighting.philips.com.
 4. USHIO America, Inc.: www.ushio.com.
 5. Venture Lighting International, Inc.: www.venturelighting.com.
 6. Substitutions: See Section 01 6000 - Product Requirements.
 7. Manufacturer Limitations: Where possible, provide lamps produced by single manufacturer.
 8. Where specific manufacturer or model is indicated elsewhere in luminaire schedule or on drawings, substitutions are not permitted unless explicitly indicated.
- C. General Requirements.
 1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
 2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps in accordance with luminaire manufacturer's recommendations.
 3. Minimum Efficiency: Provide lamps complying with current applicable federal and state lamp efficiency standards.
 4. Lamp shape and base as indicated on drawings.
 5. Universal operating burn position, unless otherwise indicated on drawings.

6. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by Architect-Engineer to be inconsistent in perceived color temperature.
7. Shall be Reduction of Hazardous Substances (RoHS) compliant.
www.rohs.eu/english/index.html.
8. Underwriters Laboratory (UL935), Class P, Type 1 Outdoor or Type 2 Indoor listed.
- D. Halogen Lamps: Wattage and bulb type as indicated, with base type as required for lighting fixture; 130 V rated.
- E. Compact Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
 1. Low Mercury Content: Provide lamps that pass EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
 2. Correlated Color Temperature (CCT): 4,100 K unless otherwise indicated.
 3. Color Rendering Index (CRI): Not less than 80.
 4. Average Rated Life: Not less than 10,000 hours for operating cycle of three hours per start.
 5. Lumen maintenance: 90 percent at 40 percent rated life.
 6. Suitable for use with dimming ballasts unless otherwise indicated on drawings.
 7. Meets Federal minimum for efficiency standards.
 8. Minimum reliable starting temperature: Minus 29 degrees C (minus 20 degrees F).
 9. T5 Long twin tube (4-pin).
 - a. Available nominal sizes, Initial lumens, Average rated life, and nominal length.
 - 1) 18 watts, 1250 lumens, and 20,000 hours for 10.5 inches.
 - 2) 24 and 27 watts, 1800 lumens, and 12,000 hours for 13.0 inches.
 - 3) 36 and 39 watts, 2850 lumens, and 12,000 hours for 16.5 inches.
 - 4) 40 watts, 3150 lumens, and 20,000 hours for 22.5 inches.
 - 5) 50 watts, 4000 lumens, and 14,000 hours for 22.5 inches.
 - 6) 55 watts, 4800 lumens, and 10,000 hours for 21.0 inches.
 - 7) 80 watts, 6000 lumens, and 12,000 hours for 22.5 inches.
 10. T4 Triple twin tube (4-pin).
 - a. Nominal wattage, Initial Lumens, and nominal length.
 - 1) 13 watts and 900 lumens for 4.0 inches.
 - 2) 18 watts and 1200 lumens for 4.5 inches.
 - 3) 26 watts and 1800 lumens for 5.0 inches.
 - 4) 32 watts and 2400 lumens for 5.5 inches.
 - 5) 42 watts and 3200 lumens for 6.5 inches.
 - 6) 57 watts and 4300 lumens for 7.5 inches.
 - 7) 70 watts and 5200 lumens for 9.0 inches.
 - b. Average rated life, 12,000 hours at 3 hours between starts and 20,000 hours at 12 hours between starts.
 11. T4 Double twin tube (4-pin).
 - a. Nominal wattage, Initial Lumens, and nominal length.
 - 1) 13 watts and 900 lumens for 4.5 inches.
 - 2) 18 watts and 1200 lumens for 6.0 inches.
 - 3) 26 watts and 1800 lumens for 7.0 inches.
 - b. Average rated life, 12,000 hours at 3 hours between starts and 20,000 hours at 12 hours between starts.
 12. Twin tube (2-pin).
 - a. Nominal wattage, Initial Lumens, and nominal length.
 - 1) 5 watts and 230 lumens for 4.0 inches.
 - 2) 7 watts and 400 lumens for 5.5 inches.
 - 3) 9 watts and 580 lumens for 6.5 inches.
 - 4) 13 watts and 800 lumens for 7.0 inches.

- b. Average rated life, 10,000 hours.
- F. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
 - 1. Low Mercury Content: Provide lamps that pass EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
 - 2. T8 Linear Fluorescent Lamps.
 - a. Correlated Color Temperature (CCT): 4,100 K unless otherwise indicated.
 - b. Color Rendering Index (CRI): Not less than 80.
 - c. Average Rated Life: Not less than 20,000 hours for operating cycle of three hours per start.
 - d. Lumen maintenance: 95 percent at 40 percent rated life.
 - e. Suitable for use with dimming ballasts unless otherwise indicated on drawings.
 - f. Meets Federal minimum for efficiency standards.
 - g. Minimum reliable starting temperature: Minus 29 degrees Celsius (minus 20 degrees Fahrenheit).
 - h. Standard rapid start.
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 17 watts and 1350 lumens for 24 inch.
 - (b) 25 watts and 2150 lumens for 36 inch.
 - (c) 32 watts and 2950 lumens for 48 inch.
 - (d) 59 watts and 5900 lumens for 96 inch.
 - 2) Average rated life.
 - (a) 20,000 hours at 3 hours between starts and 24,000 hours at 12 hours between starts for 24 inch, 36 inch, and 48 inch.
 - (b) 15,000 hours at 3 hours between starts and 20,000 hours at 12 hours between starts for 96 inch.
 - i. Extended Performance rapid start.
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 17 watts and 1350 lumens for 24 inch.
 - (b) 25 watts and 2150 lumens for 36 inch.
 - (c) 32 watts and 2950 lumens for 48 inch.
 - (d) 59 watts and 5900 lumens for 96 inch.
 - 2) Average rated life, 24,000 hours at 3 hours between starts and 29,000 hours at 12 hours between starts.
 - j. Energy saving rapid start.
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 15 watts and 1200 lumens for 24 inch.
 - (b) 22 watts and 1925 lumens for 36 inch.
 - (c) 30 watts and 2950 lumens for 48 inch.
 - 2) Average rated life.
 - (a) 24,000 hours at 3 hours between starts and 29,000 hours at 12 hours between starts for 24 inch, and 36 inch.
 - (b) 30,000 hours at 3 hours between starts and 36,000 hours at 12 hours between starts for 48 inch.
 - k. Ultra energy saving rapid start.
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 28 watts and 2725 lumens for 48 inch.
 - 2) Average rated life.
 - (a) 36,000 hours at 3 hours between starts and 42,000 hours at 12 hours between starts for 24 inch, 36 inch, and 48 inch.
 - l. High Output rapid start (48 inch) and recessed double contact (96 inch).
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 32 watts and 4000 lumens for 48 inch.
 - (b) 86 watts and 8200 lumens for 96 inch.

- 2) Average rated life.
 - (a) 24,000 hours at 3 hours between starts and 29,000 hours at 12 hours between starts for 48 inch.
 - (b) 18,000 hours at 3 hours between starts for 96 inch.
 3. T5 Linear Fluorescent Lamps.
 - a. Correlated Color Temperature (CCT): 4,100 K unless otherwise indicated.
 - b. Color Rendering Index (CRI): Not less than 80.
 - c. Average Rated Life: Not less than 20,000 hours for operating cycle of three hours per start.
 - d. Lumen maintenance: 95 percent at 40 percent rated life.
 - e. Suitable for use with dimming ballasts unless otherwise indicated on drawings.
 - f. Meets Federal minimum for efficiency standards.
 - g. Average rated life, 20,000 hours at 3 hours between starts and 24,000 hours at 12 hours between starts.
 - h. High efficiency programmed start.
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 14 watts and 1350 lumens for 24 inch.
 - (b) 21 watts and 2100 lumens for 36 inch.
 - (c) 28 watts and 2900 lumens for 48 inch.
 - (d) 35 watts and 3650 lumens for 60 inch.
 - i. High Output programmed start.
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 24 watts and 2000 lumens for 24 inch.
 - (b) 39 watts and 3500 lumens for 36 inch.
 - (c) 54 watts and 5000 lumens for 48 inch.
 - (d) 80 watts and 7000 lumens for 60 inch.
- G. Light Emitting Diode (LED).
1. General.
 - a. Lamp shape and base: Bar.
 - b. Meets Federal minimum for efficiency standards.
 - c. EPA Toxicity Characteristic Leaching Procedure (TCLP) compliant.
 - d. Lumen maintenance in accordance with LM-80.
 - e. Color Rendering Index (CRI): Greater than 65.
 - f. Correlated Color Temperature (CCT): 5000 Kelvin.
 2. Nominal wattage, Initial Lumens, and length.
 - a. 72 watts and 6,200 lumens for 72 lamps.
 - b. 84 watts and 8,000 lumens for 84 lamps.
 - c. 96 watts and 12,000 lumens for 96 lamps.
 - d. 108 watts and 17,000 lumens for 108 lamps.
 - e. 120 watts and 15,572 lumens for 120 lamps.
 - f. 132 watts and 27,000 lumens for 132 lamps.
 - g. 144 watts and 36,000 lumens for 144 lamps.
 3. Average rated life: 50,000 hours.
 4. Luminaire manufacturer shall submit reliability reports indicating that manufacturer of LED (chip, diode, or package) has performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on LEDs as follows.
 - a. High Temperature Operating Life (HTOL).
 - b. Room Temperature Operating Life (RTOL).
 - c. Low Temperature Operating Life (LTOL).
 - d. Powered Temperature Cycle (PTMCL).
 - e. Non-Operating Thermal Shock (TMSK).
 - f. Mechanical Shock.
 - g. Variable Vibration Frequency.

- h. Solder Heat Resistance (SHR).
- 5. Acceptable products.
 - a. General Electric Company/GE Lighting.
 - b. Osram Sylvania:
 - c. Philips Lighting Company:
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.08 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2 inch size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4 inch size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.
- D. Tube Guards for Linear Fluorescent Lamps: Provide clear virgin polycarbonate sleeves with endcaps where indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's recommended installation procedures and instructions.
- C. Install luminaires securely, in neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).
- D. Install luminaires, emergency lighting units, exit signs, and remote light heads plumb and square and aligned with building lines and with adjacent luminaires. Support from building steel, masonry block, or reinforced drywall partitions. Secure to prevent movement
- E. Suspended Ceiling Mounted Luminaires.
 - 1. Do not use ceiling tiles to bear weight of luminaires.
 - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
 - 3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
 - 4. Secure pendant-mounted luminaires to building structure.
 - 5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
 - 6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.

7. See appropriate Division 09 section where suspended grid ceiling is specified for additional requirements.
- F. Recessed Luminaires.
 1. Install trims tight to mounting surface with no visible light leakage.
 2. Install recessed ceiling luminaires as indicated on the reflected ceiling plan.
 3. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
 4. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
 5. Install clips to secure recessed grid-supported luminaires in place.
 6. Install minimum of four adjustable wing type hangers for each four-foot unit to secure non-lay-in type recessed luminaires.
- G. Suspended Luminaires.
 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
 2. Install using suspension method indicated, with support lengths and accessories as required for specified mounting height.
 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
 4. Install canopies tight to mounting surface.
 5. Unless otherwise indicated, support pendants from swivel hangers.
- H. Wall-Mounted Luminaires: Unless otherwise indicated on drawings, specified mounting heights are to center of luminaire.
- I. Make wiring connections to branch circuit using building wire with insulation rating suitable for temperature conditions within luminaire.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Fluorescent Luminaires Controlled by Dual-Level Switching: Connect such that each switch controls same corresponding lamps in each luminaire.
- M. Mount Fuse Holders for Fluorescent Fixtures.
 1. In protected location within inside wiring channel or ballast enclosure.
 2. Accessible for convenient fuse changing.
- N. Mount Fuse Holders for LED Fixtures.
 1. In protected location within driver housing.
 2. Accessible for convenient fuse changing.
- O. Emergency Lighting Units.
 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
 2. Install lock-on device on branch circuit breaker serving units.
- P. Exit Signs.
 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
 2. Install lock-on device on branch circuit breaker serving units.
- Q. Fluorescent Emergency Power Supply Units.
 1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire.
 2. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal ballast(s) in luminaire. Bypass local switches, contactors, or other lighting controls.
 3. Install lock-on device on branch circuit breaker serving units.

- R. Remote Ballasts: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.
- S. Install lamps in each luminaire.
- T. Lamp Burn-In: Operate lamps at full output for prescribed period in accordance with manufacturer's recommendations prior to use with dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.04 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect-Engineer.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect-Engineer. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect-Engineer or authority having jurisdiction.
- C. Air-Handling Luminaires with Air Control Blades or Heat Removal Dampers: Adjust as indicated or as required for proper airflow as directed by Architect-Engineer.
- D. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect-Engineer or authority having jurisdiction.
- E. Adjust to align with building lines and with each other.

3.06 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of luminaires to Architect-Engineer, and correct deficiencies or make adjustments as directed.
- D. Just prior to Substantial Completion, replace lamps that have failed.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 5600
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Ballasts, generators, and drivers.
- C. Fluorescent emergency power supply units.
- D. Metal Halide emergency power supply units.
- E. Lamps.
- F. Poles and accessories.
- G. Luminaire accessories.

1.02 RELATED REQUIREMENTS

- A. Section 26 0130 - Acceptance Testing.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0537 - Boxes.
- D. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including outdoor motion sensors, time switches, and outdoor photo controls.
- E. Section 26 2726 - Wiring Devices: Receptacles for installation in poles.
- F. Section 26 2813 - Fuses.
- G. Section 26 5100 - Interior Lighting.

1.03 REFERENCE STANDARDS

- A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals; American Association of State Highway and Transportation Officials; 5th Edition, with 2011 Interim Revisions
- B. ANSI C78.377 - American National Standard for the Chromaticity of Solid State Lighting Products; 2008.
- C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.
- D. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.
- E. ANSI C82.SSL1 - SSL Drivers - in ANSI Development; 2002.
- F. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.
- G. ANSI O5.1 - American National Standard for Wood Poles -- Specifications and Dimensions; 2008.
- H. ANSI/ASHRAE/IESNA Standard 90.1-2007 Energy Standard for Buildings Except Low-Rise Residential Buildings.
- I. IEEE C2 - National Electrical Safety Code; 2012.
- J. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).
- K. IESNA - The Illuminating Engineering Society of North America (IESNA) Lighting Handbook Reference and Application, 2000, 9th Edition.
- L. IESNA LM-5 - Photometric Measurements of Area and Sports Lighting Installations; 2004 (Reaffirmed 2007).

- M. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- N. IESNA LM-64 - Photometric Measurements of Parking Areas; 2001 (Reaffirmed 2007).
- O. IESNA LM-79 - Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.
- P. IESNA LM-80 - Approved Method for Measuring Lumen Maintenance of LED Light Sources; 2008.
- Q. IESNA RP-8 - American National Standard Practice for Roadway Lighting; Illuminating Engineering Society of North America; 2000(R2005) (ANSI/IES RP8).
- R. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- S. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.
- T. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Fluorescent Ballasts; National Electrical Manufacturers Association; 2011.
- U. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2012.
- V. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- W. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2009.
- X. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- Y. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.
- Z. UL 1029 - High-Intensity-Discharge Lamp Ballasts; Current Edition, Including All Revisions.
- AA. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- AB. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination.
 - 1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
 - 2. Notify Architect-Engineer of any conflicts or deviations from contract documents to obtain direction prior to proceeding with work.
- B. Conditions
 - 1. Refer to Space Illuminance Levels, Categories, and Design Guide Schedule on drawings.
- C. Compliance.
 - 1. Energy performance and optimization must comply with EPACT 2005.
 - 2. 80 percent of luminaire material by weight should be recyclable at end of life. Luminaire shall be designed for end-of-life disassembly.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings.
 - 1. Prior to shop drawing submittal.
 - a. Verify lighting controls on drawings for proper types of options required on fixtures.
 - b. Verify wiring on drawings for proper types of options required on fixtures.
 - 2. Indicate dimensions and components for each luminaire.
 - 3. Exterior light fixture shop drawings must be submitted at one time.
 - 4. Provide photometric calculations where luminaires are proposed for substitution upon request.

5. Provide structural calculations for each pole proposed for substitution.
 6. Substitutions of light fixtures that are not listed in fixture schedule shall be rejected. Any light fixture substitutions required, shall be preapproved before bid as indicated in fixture schedule.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features. Provide manufacturer's standard catalog pages and data sheets including detailed information on lamps and ballasts.
1. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.
 2. Submit fixture shop drawings in booklet form with separate sheet(s) for each fixture, assembled per "luminaire type" in fixture schedule order, with proposed fixture and accessories clearly indicated on each sheet. Light fixture cut sheets shall include as a minimum, fixture efficiency as specified, Target Efficacy Rating (TER), mounting, lamp quantity, reflector, diffuser, lens trim type, wiring diagrams, list of compatible lamp configurations, and options and accessories. Shop drawings clearly indicate which options are provided with each fixture.
 3. For each fixture requiring ballast, generator, or driver, provide separate ballast cut sheets for each type of ballast provided along with lighting fixture booklets. Ballast cut sheets shall include as minimum: input wattage, wiring diagrams, Total Harmonic Distortion (THD), Ballast Factor (BF), and Power Factor (PF). Shop drawings shall clearly indicate which ballast type is provided with each fixture.
 4. Submit separate lamp cut sheets for each type of lamp provided along with lighting fixture booklets. Lamp cut sheets shall include as minimum: color temperature, Color Rendering Index (CRI), rated life, initial and mean lumen output. Shop drawings clearly indicate which lamp type is provided with each fixture.
 5. Submit separate pole cut sheets for each type of pole provided along with lighting fixture booklets. Pole cut sheets shall include as minimum: shaft length, shaft size, wall thickness, gauge, bolt circle size, bolt size, bolt projection, hand hole size, conduit access size, information on maximum supported effective projected area (EPA), and weight for design wind speed.
 6. Fluorescent Emergency Power Supply Unit: Include list of compatible lamp configurations and associated lumen output.
- D. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for luminaires to be installed and comply with designated structural design criteria.
- E. Field Quality Control Reports.
1. Include test report indicating measured illumination levels.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- H. Manufacturer's Material Safety Data Sheets (MSDS): Include safety data sheets on component materials.
- I. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

- B. Products: Listed and classified by Underwriter's Laboratories Inc. (UL) as suitable for purpose specified and indicated.
- C. Maintain at project site, copy of each referenced document that prescribes execution requirements.
- D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- E. Conduct testing in accordance with applicable IESNA and ANSI approved methods for product(s).

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.
- C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

1.08 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead load weight of luminaire, supports, lowering devices as stated in AASHTO LTS-4.
- B. Design fixtures and poles for wind load pressures conforming to International Building Code.

1.09 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for ballasts and drivers.
- C. Provide three year full warranty for fluorescent emergency power supply units.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LUMINAIRE REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.
- D. Provide products complying with Federal Energy Management Program (FEMP) requirements.
- E. Unless otherwise indicated, provide complete luminaires including lamp(s) or tube(s), and sockets, ballasts, reflectors, lenses, fuses, supports, brackets, canopies, globes, housings, and other components required to position, energize operate, and protect lamp and distribute light.
- F. Unless specifically indicated to be excluded, provide required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for complete operating system.
- G. Provide products suitable to withstand normal handling, installation, and service without damage, distortion, corrosion, fading, discoloring, etc.
- H. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
- I. Provide luminaires with metal parts that are free of burrs, sharp corners, and edges.
- J. Constructed of corrosion-resistant aluminum.

- K. Rigidly formed housings that provide weathertight and lighttight enclosures.
- L. Doors and frames shall prevent accidental falling during relamping or ballast replacement.
- M. Heat and aging-resistant resilient gasket to seal lenses to luminaire door.
- N. Recessed Luminaires.
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
 - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
 - 4. Troffers.
 - a. In plaster ceilings, furnish suitable plaster frames.
 - b. In other types of ceilings, flanges covering joints between fixtures and ceiling.
 - c. Design for individual or continuous mounting in ceiling.
 - 5. Downlights.
 - a. In plaster ceilings, furnish suitable plaster frames.
 - b. In other types of ceilings, flanges covering joints between fixtures and ceiling.
 - c. Do not mount straddling expansion or decorative joints.
- O. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with accessories required for joining and aligning.
- P. Fluorescent Luminaires.
 - 1. Provide ballast disconnecting means complying with NFPA 70 where required.
 - 2. Fluorescent Luminaires Controlled by Occupancy Sensors: Provide programmed start or programmed rapid start ballasts.
- Q. LED Luminaire Components: UL 8750 recognized or listed as applicable.
 - 1. Provide driver disconnecting means complying with NFPA 70 where required.
 - 2. Listed and labeled as complying with UL 8750.
 - 3. LED-dedicated Luminaire Expected Useful Life (Light Output) and Depreciation shall be as specified by one of following.
 - a. Simplified L70 threshold as described in LM-79-08.
 - b. Site defined performance method as described on LM-8-08.
 - 4. Provide End-of-Life mechanism into luminaire. When LED die output has reached end of useful life, luminaire should enter "failure mode".
- R. Furnish Fuse Protection for fluorescent and LED Fixtures.
 - 1. On line side of ballasts to protect ballast and lamps.
 - 2. Shall not open unnecessarily within range of plus or minus 10 percent of rated voltage of luminaire.
- S. Exposed Hardware: Stainless steel.

2.03 BALLASTS, GENERATORS, DRIVERS, AND CONTROL UNITS

- A. Furnish products as indicated in luminaire schedule included on drawings.
- B. Manufacturers.
 - 1. General Electric Company/GE Lighting: www.gelighting.com.
 - 2. Osram Sylvania: www.sylvania.com.
 - 3. Philips Lighting Electronics/Advance: www.advance.philips.com.
 - 4. Universal Lighting Technologies: <http://unvlt.com>.
 - 5. Substitutions: Luminaire Manufacturer's Equivalent Ballast.
 - 6. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by single manufacturer.
 - 7. Where specific manufacturer or model is indicated elsewhere in luminaire schedule or on drawings, substitutions are not permitted unless explicitly indicated.
- C. General Requirements.
 - 1. Provide ballasts not containing polychlorinated biphenyls (PCBs).

2. Minimum Efficiency/Efficacy: Provide ballasts complying with current applicable federal and state ballast efficiency/efficacy standards.
 3. Certify ballast design and construction by Certified Ballast Manufacturers, Inc.
 4. Shall be Reduction of Hazardous Substances (RoHS) compliant.
www.rohs.eu/english/index.html.
 5. Underwriters Laboratories (UL 935), Class P, Type 1 Outdoor or Type 2 Indoor listed.
- D. Electronic Fluorescent Ballasts.
1. Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
 - a. Inrush Current: Not exceeding peak currents specified in NEMA 410.
 - b. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
 - c. Single- or Multi-voltage sensing.
 - d. Total Harmonic Distortion: Not greater than 10 percent.
 - e. Power Factor: Not less than 0.95.
 - f. Ballast Factor: Normal ballast factor between 0.87 and 0.89, unless otherwise indicated.
 - g. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
 - h. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
 - i. Lamp Compatibility: Specifically designed for use with specified lamp, without visible flicker.
 - j. Lamp Operating Frequency: Greater than 40 kHz.
 - 1) Do not operate lamp(s) within frequencies from 30 kHz through 40 kHz in order to avoid interference with infrared devices.
 - k. Lamp Current Crest Factor: Not greater than 1.7.
 - l. Lamp Wiring Method.
 - 1) Instant Start Ballasts: Parallel wired.
 - 2) Rapid Start Ballasts: Series wired.
 - 3) Programmed Start Ballasts: Provide parallel or series/parallel wired where available; otherwise series wired is acceptable.
 - m. Lamp Starting Method.
 - 1) Instant Start Ballasts.
 - (a) Design for 10,000 to 15,000 starts.
 - (b) High initial voltage of 600 volts to start lamp.
 - (c) Provide Independent Lamp Operation (ILO) to allow remaining lamps to maintain full light output when one or more lamps fail.
 - 2) Rapid Start Ballasts.
 - (a) Design for 15,000 to 20,000 starts.
 - (b) Initial voltage of 500 volts to start lamp.
 - 3) Programmed Start Ballasts.
 - (a) Design for use with occupancy sensors by providing 50,000 starts minimum.
 - (b) Precise cathode heating to 700 degrees C prior to lamp ignition.
 - (c) Provide Independent Lamp Operation (ILO) to allow remaining lamps to maintain full light output when one or more lamps fail.
 - n. Lamp Starting Temperature: Capable of starting standard lamp(s) at minimum of 0 degrees F unless otherwise indicated.
 - o. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
 - p. Provide end of lamp life automatic shutdown circuitry for T5 and smaller diameter lamp ballasts.
 - q. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location Category A.

- r. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.
 - s. Provide high efficiency T8 lamp ballasts certified as NEMA premium where indicated.
 - t. Provide lamp striation reduction circuitry where indicated.
 - u. Ballast Marking: Include wiring diagrams with lamp connections.
 - 2. Non-Dimming Fluorescent Ballasts.
 - a. Lamp Starting Method.
 - 1) T8 Lamp Ballasts: Programmed start unless otherwise indicated.
 - (a) Minimum ballast factor (BF) for primary lamp application of.
 - (1) 0.77-0.78 for low wattage.
 - (2) 0.87-0.89 for normal light output.
 - (3) 1.15-1.20 for high light output.
 - (b) Acceptable products.
 - (1) Advance Transformer: Optanium 2.0.
 - (2) General Electric: UltraStart.
 - (3) Osram Sylvania: QuickTronic.
 - (4) Universal: AccuStart.
 - (c) Substitutions: Luminaire Manufacturer's Equivalent Ballast.
 - b. T5 Lamp Ballasts: Programmed start unless otherwise indicated.
 - 1) Minimum ballast factor (BF) for primary lamp application of.
 - (a) 0.77-0.78 for low wattage.
 - (b) 0.87-0.89 for normal light output.
 - (c) 1.15-1.20 for high light output.
 - 2) Contain hi-low switching option when operating four F54T5/HO lamps to allow switching from 4-2 lamps, 3-2 lamps, or 3-1 lamps.
 - 3) Acceptable products.
 - (a) Advance Transformer: Centium.
 - (b) General Electric: UltraStart.
 - (c) Osram Sylvania: QuickTronic.
 - (d) Universal: AccuStart.
 - (e) Substitutions: Luminaire Manufacturer's Equivalent Ballast.
 - c. Compact Fluorescent Lamp Ballasts: Programmed start unless otherwise indicated.
 - 1) Minimum ballast factor (BF): 0.95 for primary lamp application.
 - 2) 4-pin lamp base wherever possible.
 - 3) Acceptable products.
 - (a) Advance Transformer: SmartMate.
 - (b) General Electric: C Series.
 - (c) Osram Sylvania: QuickTronic.
 - (d) Universal: MicroStar.
 - (e) Substitutions: Luminaire Manufacturer's Equivalent Ballast.
 - 3. Lamp Starting Temperature: Capable of starting standard lamp(s) at minimum of 0 degrees F, and energy saving lamp(s) at minimum of 60 degrees F unless otherwise indicated.
- E. Dimming Fluorescent Ballasts.
 - 1. Control Scheme.
 - a. Four-wire low voltage (0-10 V).
 - 1) Minimum ballast factor (BF) of 1.00 at maximum light output and 0.03 at minimum light output for primary lamp application.
 - 2) Control lamp relative light output from.
 - (a) 100 percent to Three percent for T8 and CFL lamps.
 - (b) 100 percent to One percent for T5/HO lamps.
 - 3) Controlled by a compatible 4-wire, Class 1 or Class 2 low voltage 0 to 10 VDC controller.

- 4) Integral protection circuitry to withstand connection of low voltage control leads to mains power supply. Ballast shall default to maximum light output in this event.
 - 5) Acceptable products.
 - (a) Advance Transformer: Mark 7.
 - (b) General Electric: UltraStart.
 - (c) Lutron: TVE.
 - (d) Osram Sylvania: QuickTronic.
 - (e) Universal: AccuStart.
 2. Full lumen output of lamps.
 3. Control Compatibility: Fully compatible with dimming controls to be installed.
 - a. Wall Dimmers: See Section 26 2726.
 - b. Daylighting Controls: See Section 26 0923.
 4. Lamp Starting Method: Programmed start unless otherwise indicated.
 5. Lamp Starting Temperature: Capable of starting lamp(s) at minimum of 50 degrees F.
 6. Dimmed Lamp Starting: Capable of starting lamp(s) at any dimmed preset without transitioning first to full light output.
- F. High Intensity Discharge (HID) Ballasts: Unless otherwise indicated, provide electromagnetic ballasts complying with ANSI C82.4 and listed and labeled as complying with UL 1029.
1. Electronic Light Emitting Diode (LED) Drivers: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
 - a. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
 - b. Total Harmonic Distortion: Not greater than 20 percent.
 - c. Power Factor: Not less than 0.90.
 - d. Dimming Range: Continuous dimming from 100 percent to one percent relative light output, without flicker and with even tracking across multiple lamps.
 - e. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
 - f. Lamp Operating Frequency: Greater than 60 hertz or higher.
 - g. Lamp Current Crest Factor: Not greater than 1.5.
 - h. Lamp Starting Temperature: Capable of starting standard lamp(s) at a minimum of minus 40 degrees Fahrenheit.
 - i. Minimum driver efficiency of 85 percent.
 - j. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
 - k. Designed for use with occupancy sensors by providing 50,000 starts minimum.
 - l. Provide End-of-Life (EOL) automatic shutdown circuitry.
 - m. Surge Tolerance: Capable of withstanding 250 repetitive strikes of "C Low" (C Low – 6kV/1.2 x 50 μ s, 10kA/8 x 20 μ s) waveforms at 1 minute intervals with less than 10 percent degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2, location Category A.
 - n. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.
 - o. Acceptable products.
 - 1) Advance Transformer: Xitanium.
 - 2) Osram Sylvania: Optotronic.
 - 3) Substitutions: Luminaire Manufacturer's Equivalent Ballast.

2.04 FLUORESCENT EMERGENCY POWER SUPPLY UNITS

- A. Furnish products as indicated in luminaire schedule included on drawings.
- B. Manufacturers.
 1. Iota Engineering, LLC: www.iotaengineering.com.

2. Lithonia Lighting: www.lithonia.com.
 3. Philips Emergency Lighting/Bodine: www.bodine.com.
 4. Substitutions: Luminaire Manufacturer's Equivalent Ballast.
 5. Manufacturer Limitations: Where possible, for each type of luminaire provide fluorescent emergency power supply units produced by single manufacturer.
 6. Where specific manufacturer or model is indicated elsewhere in luminaire schedule or on drawings, substitutions are not permitted unless explicitly indicated.
- C. Description: Self-contained fluorescent emergency power supply units suitable for use with indicated luminaires.
- D. Conform To.
1. NFPA 101 Life Safety Code and applicable state and local codes.
 2. Listed and labeled as complying with UL 924, Emergency Lighting and Power Equipment.
 3. NEC and OSHA illumination Requirements.
 4. Metallic or polycarbonate housing, flame rating of 0 in accordance with UL 94V.
- E. Compatibility.
1. Ballasts: Compatible with electronic, standard magnetic, energy saving, dimming AC ballasts including instant start, rapid start, program start, and those with end of lamp life shutdown circuits.
 2. Lamps: Compatible with low-mercury lamps.
- F. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to fluorescent emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source unless noted otherwise.
- G. Operating voltage: Dual input 120/277.
- H. Battery.
1. Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated.
 2. Three year shelf life, 7 to 9 year expected life at rated operating temperature.
- I. Charger.
1. Electronic, constant current or constant series resistor.
 2. Capacitive input circuit.
 3. High efficiency push-pull inverter.
 4. Fully recharges within 24 hours.
- J. Mounting and output.
1. Full output, fluorescent linear and compact, externally/remotely mounted on wall or ceiling.
 - a. Remote mounting on fixture or adjacent to, plenum rated.
 - b. Performance.
 - 1) One-lamp operation (1 to 4 lamp ballasts), or 2-lamp operation (2 to 4 lamp ballasts).
 - 2) Minimum initial output: 1450 to 3500 lumens depending on lamp type.
 - 3) Minimum output: Approximately 3000 lumens over 90 minute duration (based on one 32 watt, T8 lamp with energy saving rapid start ballast).
 - c. Lamp types.
 - 1) U-lamp, T8.
 - 2) Linear, 24 inches to 96 inches: T8 or T8HO.
 - 3) Linear, 24 inches to 48 inches: T5 or T5HO.
 - 4) 12 inch to 24 inch long twin tube (4-pin).
 - 5) Quad tube (4-pin).
 - 6) Triple tube (4-pin).
 - d. Acceptable manufacturers (verify compatibility with ballast/lamp used).
 - 1) Bodine, B30 Series.
 - 2) Chloride, C3000 Series.
 - 3) Cornerstone/Hubbell, EFP6 Series.

- 4) Dual-Lite, UFO-7W Series.
- 5) Emergi-Lite, FPS--HL Series (Thomas & Betts Corporation).
- 6) Lightalarms, AM30 Series (Thomas & Betts Corporation).
- 7) Lithonia, PS3000 Series.
- 8) Side-Lites, S96F Series.
- 9) Sure-Lite, FBP35000 Series.
- 10) Substitutions: See Section 01 6000 - Product Requirements.
2. Four-pin, compact fluorescent, externally mounted on wall or ceiling.
 - a. Remote mounting on fixture or adjacent to, plenum rated.
 - b. Performance.
 - 1) Operates connected load for minimum of 90 minutes.
 - 2) Operates one 4-pin compact fluorescent lamp.
 - 3) Minimum initial output of 450 to 950 lumens depending on lamp type.
 - c. Lamp types (4-pin).
 - 1) Triple tube (32 to 70 watts).
 - d. Acceptable manufacturers (verify compatibility with ballast/lamp used).
 - 1) Bodine, B75C Series.
 - 2) Chloride.
 - 3) Cornerstone/Hubbell.
 - 4) Dual-Lite.
 - 5) Emergi-Lite (Thomas & Betts Corporation).
 - 6) Lightalarms (Thomas & Betts Corporation).
 - 7) Lithonia, PSDL Series.
 - 8) Side-Lites.
 - 9) Sure-Lite.
 - 10) Substitutions: See Section 01 6000 - Product Requirements.
3. Interim lighting for generator backup or central inverter system, fluorescent linear and compact, externally/remotely mounted on wall or ceiling.
 - a. Performance.
 - 1) Operates connected load for minimum of 5 minutes.
 - 2) One-lamp operation (1 to 4 lamp ballasts), or 2-lamp operation (2 to 4 lamp ballasts).
 - 3) Minimum initial output of 1050 to 3200 lumens depending on lamp type.
 - b. Lamp types.
 - 1) U-lamp, T8.
 - 2) Linear, 24 inches to 48 inches: T8 or T8HO.
 - 3) Linear, 24 inches to 48 inches: T5 or T5HO.
 - 4) Long twin tube (4-pin).
 - 5) Quad tube (4-pin).
 - 6) Triple tube (4-pin).
 - c. Acceptable manufacturers (verify compatibility with ballast/lamp used).
 - 1) Bodine, Gen Series: www.bodine.com
 - 2) NINE 24 Inc.: www.924inc.com
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
4. Auxiliary Transfer Ballast.
 - a. General.
 - 1) Work with standby generator or central inverter system to power emergency lighting regardless of local light switch position (on/off).
 - 2) Allow emergency lighting to operate on switched circuitry instead of night lighting circuitry.
 - 3) AC Input Current: 280 mA.
 - b. Power Switching Device, channel mounted inside most luminaires, or externally/remotely mounted on wall or ceiling.
 - 1) Performance.

- (a) Consists of relay switching circuitry and fusing.
 - (b) Operating temperature: 0 degree C (plus 32 degrees F) to plus 50 degrees C (plus 122 degrees F).
 - (c) AC Input Power Rating: 1.6 watts.
 - (d) Current rating: 3A.
 - 2) Lamp types.
 - (a) For fluorescent loads only.
 - 3) Acceptable manufacturers.
 - (a) Bodine, GTD Series.
 - (b) Dual-Lite, ATSD Series.
 - (c) Side-Lite, PSM Series.
 - (d) Substitutions: See Section 01 6000 - Product Requirements.
- c. Switch Bypass Device, externally/remotely mounted on wall or ceiling.
 - 1) Performance.
 - (a) Consists of relay switching circuitry, test switch, normal power indicator light, emergency power indicator light, and fusing.
 - (b) Operating temperature: Minus 20 degrees C (minus 4 degrees F) to 55 degrees C (131 degrees F).
 - (c) AC Input Power Rating: 3.5 watts.
 - (d) Current rating: 20A.
 - 2) Lamp types.
 - (a) For fluorescent, Incandescent, and HID loads.
 - 3) Acceptable manufacturers.
 - (a) Bodine, GTD20 Series.
 - (b) Side-Lite, SBD20 Series.
 - (c) Substitutions: See Section 01 6000 - Product Requirements.
- K. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status and field selectable audible alert.
- L. Operating Temperature: From 32 degrees F to 122 degrees F unless otherwise indicated or required for installed location.
- M. Accessories.
 - 1. Provide compatible accessory remote combination test switch/indicator light.

2.05 LAMPS

- A. Furnish products as indicated in luminaire schedule included on the Drawings.
- B. Manufacturers.
 - 1. General Electric Company/GE Lighting: www.gelighting.com.
 - 2. Osram Sylvania: www.sylvania.com.
 - 3. Philips Lighting Company: www.lighting.philips.com.
 - 4. USHIO America, Inc.: www.ushio.com.
 - 5. Venture Lighting International, Inc.: www.venturelighting.com.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
 - 7. Manufacturer Limitations: Where possible, provide lamps produced by single manufacturer.
 - 8. Where specific manufacturer or model is indicated elsewhere in luminaire schedule or on drawings, substitutions are not permitted unless explicitly indicated.
- C. All Lamps.
 - 1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
 - 2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps in accordance with luminaire manufacturer's recommendations.
 - 3. Minimum Efficiency: Provide lamps complying with current applicable federal and state lamp efficiency standards.

4. Lamp shape and base as indicated on drawings.
 5. Universal operating burn position, unless otherwise indicated on drawings.
 6. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by Architect-Engineer to be inconsistent in perceived color temperature.
 7. Shall be Reduction of Hazardous Substances (RoHS) compliant.
www.rohs.eu/english/index.html.
 8. Underwriters Laboratories (UL935), Class P, Type 1 Outdoor or Type 2 Indoor listed.
- D. Compact Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
1. Low Mercury Content: Provide lamps that pass EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
 2. Correlated Color Temperature (CCT): 4,100 K unless otherwise indicated.
 3. Color Rendering Index (CRI): Not less than 80.
 4. Average Rated Life: Not less than 10,000 hours for operating cycle of three hours per start.
 5. Lumen maintenance: 90 percent at 40 percent rated life.
 6. Suitable for use with dimming ballasts unless otherwise indicated on drawings.
 7. Meets Federal minimum for efficiency standards.
 8. Minimum reliable starting temperature: Minus 29 degrees C (minus 20 degrees F).
 9. T5 Long twin tube (4-pin).
 - a. Available nominal sizes, Initial lumens, Average rated life, and nominal length.
 - 1) 18 watts, 1250 lumens, and 20,000 hours for 10.5 inches.
 - 2) 24 and 27 watts, 1800 lumens, and 12,000 hours for 13.0 inches.
 - 3) 36 and 39 watts, 2850 lumens, and 12,000 hours for 16.5 inches.
 - 4) 40 watts, 3150 lumens, and 20,000 hours for 22.5 inches.
 - 5) 50 watts, 4000 lumens, and 14,000 hours for 22.5 inches.
 - 6) 55 watts, 4800 lumens, and 10,000 hours for 21.0 inches.
 - 7) 80 watts, 6000 lumens, and 12,000 hours for 22.5 inches.
 10. T4 Triple twin tube (4-pin).
 - a. Nominal wattage, Initial Lumens, and nominal length.
 - 1) 13 watts and 900 lumens for 4.0 inches.
 - 2) 18 watts and 1200 lumens for 4.5 inches.
 - 3) 26 watts and 1800 lumens for 5.0 inches.
 - 4) 32 watts and 2400 lumens for 5.5 inches.
 - 5) 42 watts and 3200 lumens for 6.5 inches.
 - 6) 57 watts and 4300 lumens for 7.5 inches.
 - 7) 70 watts and 5200 lumens for 9.0 inches.
 - b. Average rated life: 12,000 hours at 3 hours between starts and 20,000 hours at 12 hours between starts.
 11. T4 Double twin tube (4-pin).
 - a. Nominal wattage, Initial Lumens, and nominal length.
 - 1) 13 watts and 900 lumens for 4.5 inches.
 - 2) 18 watts and 1200 lumens for 6.0 inches.
 - 3) 26 watts and 1800 lumens for 7.0 inches.
 - b. Average rated life: 12,000 hours at 3 hours between starts and 20,000 hours at 12 hours between starts.
 12. Twin tube (2-pin).
 - a. Nominal wattage, Initial Lumens, and nominal length.
 - 1) 5 watts and 230 lumens for 4.0 inches.
 - 2) 7 watts and 400 lumens for 5.5 inches.
 - 3) 9 watts and 580 lumens for 6.5 inches.
 - 4) 13 watts and 800 lumens for 7.0 inches.
 - b. Average rated life: 10,000 hours.

- E. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
1. Low Mercury Content: Provide lamps that pass EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
 2. T8 Linear Fluorescent Lamps.
 - a. Correlated Color Temperature (CCT): 4,100 K unless otherwise indicated.
 - b. Color Rendering Index (CRI): Not less than 80.
 - c. Average Rated Life: Not less than 20,000 hours for an operating cycle of three hours per start.
 - d. Lumen maintenance, 95 percent at 40 percent rated life.
 - e. Suitable for use with dimming ballasts unless otherwise indicated on drawings.
 - f. Meets Federal minimum for efficiency standards.
 - g. Minimum reliable starting temperature: Minus 29 degrees C (minus 20 degrees F).
 - h. Standard rapid start.
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 17 watts and 1350 lumens for 24 inch.
 - (b) 25 watts and 2150 lumens for 36 inch.
 - (c) 32 watts and 2950 lumens for 48 inch.
 - (d) 59 watts and 5900 lumens for 96 inch.
 - 2) Average rated life.
 - (a) 20,000 hours at 3 hours between starts and 24,000 hours at 12 hours between starts for 24 inch, 36 inch, and 48 inch.
 - (b) 15,000 hours at 3 hours between starts and 20,000 hours at 12 hours between starts for 96 inch.
 - i. Extended Performance rapid start.
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 17 watts and 1350 lumens for 24 inch.
 - (b) 25 watts and 2150 lumens for 36 inch.
 - (c) 32 watts and 2950 lumens for 48 inch.
 - (d) 59 watts and 5900 lumens for 96 inch.
 - 2) Average rated life: 24,000 hours at 3 hours between starts and 29,000 hours at 12 hours between starts.
 - j. Energy saving rapid start.
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 15 watts and 1200 lumens for 24 inch.
 - (b) 22 watts and 1925 lumens for 36 inch.
 - (c) 30 watts and 2950 lumens for 48 inch.
 - 2) Average rated life.
 - (a) 24,000 hours at 3 hours between starts and 29,000 hours at 12 hours between starts for 24 inch, and 36 inch.
 - (b) 30,000 hours at 3 hours between starts and 36,000 hours at 12 hours between starts for 48 inch.
 - k. Ultra energy saving rapid start.
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 28 watts and 2725 lumens for 48 inch.
 - 2) Average rated life.
 - (a) 36,000 hours at 3 hours between starts and 42,000 hours at 12 hours between starts for 24 inch, 36 inch, and 48 inch.
 - l. High Output rapid start (48 inch) and recessed double contact (96 inch).
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 32 watts and 4000 lumens for 48 inch.
 - (b) 86 watts and 8200 lumens for 96 inch.
 - 2) Average rated life.

- (a) 24,000 hours at 3 hours between starts and 29,000 hours at 12 hours between starts for 48 inch.
 - (b) 18,000 hours at 3 hours between starts for 96 inch.
 - 3. T5 Linear Fluorescent Lamps.
 - a. Correlated Color Temperature (CCT): 4,100 K unless otherwise indicated.
 - b. Color Rendering Index (CRI): Not less than 80.
 - c. Average Rated Life: Not less than 20,000 hours for operating cycle of three hours per start.
 - d. Lumen maintenance: 95 percent at 40 percent rated life.
 - e. Suitable for use with dimming ballasts unless otherwise indicated on drawings.
 - f. Meets Federal minimum for efficiency standards.
 - g. Average rated life, 20,000 hours at 3 hours between starts and 24,000 hours at 12 hours between starts.
 - h. High efficiency programmed start.
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 14 watts and 1350 lumens for 24 inch.
 - (b) 21 watts and 2100 lumens for 36 inch.
 - (c) 28 watts and 2900 lumens for 48 inch.
 - (d) 35 watts and 3650 lumens for 60 inch.
 - i. High Output programmed start.
 - 1) Nominal wattage, Initial Lumens, and nominal length.
 - (a) 24 watts and 2000 lumens for 24 inch.
 - (b) 39 watts and 3500 lumens for 36 inch.
 - (c) 54 watts and 5000 lumens for 48 inch.
 - (d) 80 watts and 7000 lumens for 60 inch.
- F. Light Emitting Diode (LED).
 - 1. General.
 - a. Lamp shape and base: Bar.
 - b. Meets Federal minimum for efficiency standards.
 - c. EPA Toxicity Characteristic Leaching Procedure (TCLP) compliant.
 - d. Lumen maintenance in accordance with LM-80.
 - e. Color Rendering Index (CRI): Greater than 65.
 - f. Correlated Color Temperature (CCT): 5000 Kelvin.
 - 2. Nominal wattage, Initial Lumens, and length.
 - a. 72 watts and 6,200 lumens for 72 lamps.
 - b. 84 watts and 8,000 lumens for 84 lamps.
 - c. 96 watts and 12,000 lumens for 96 lamps.
 - d. 108 watts and 17,000 lumens for 108 lamps.
 - e. 120 watts and 15,572 lumens for 120 lamps.
 - f. 132 watts and 27,000 lumens for 132 lamps.
 - g. 144 watts and 36,000 lumens for 144 lamps.
 - 3. Average rated life: 50,000 hours.
 - 4. Luminaire manufacturer shall submit reliability reports indicating that manufacturer of LED (chip, diode, or package) has performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on LEDs as follows.
 - a. High Temperature Operating Life (HTOL).
 - b. Room Temperature Operating Life (RTOL).
 - c. Low Temperature Operating Life (LTOL).
 - d. Powered Temperature Cycle (PTMCL).
 - e. Non-Operating Thermal Shock (TMSK).
 - f. Mechanical Shock.
 - g. Variable Vibration Frequency.
 - h. Solder Heat Resistance (SHR).

5. Acceptable products.
 - a. General Electric Company/GE Lighting.
 - b. Osram Sylvania:
 - c. Philips Lighting Company:
 - d. Substitutions: See Section 01 6000 - Product Requirements.

2.06 POLES

- A. Furnish products as indicated in luminaire schedule included on drawings.
- B. Manufacturers.
 1. Acuity Brands, Inc.: www.acuitybrands.com.
 2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.
 3. Hapco: www.hapco.com.
 4. Hubbell Lighting, Inc.: www.hubbelllighting.com.
 5. Sky Cast, Inc.: www.skycastinc.com.
 6. StressCrete Group: www.stresscrete.com.
 7. Valmont Industries, Inc.: www.valmont.com.
 8. Substitutions: See Section 01 6000 - Product Requirements.
- C. All Poles.
 1. Provide poles and associated support components suitable for luminaire(s) and associated supports and accessories to be installed.
 2. Structural Design Criteria.
 - a. Comply with AASHTO LTS.
 - b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
 - 1) Design Wind Speed: Ninety (90) miles per hour, with gust factor of 1.3.
 - c. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.
 - d. Include structural calculations demonstrating compliance with submittals.
 3. Material: Steel, unless otherwise indicated.
 4. Shape: Square straight, unless otherwise indicated.
 5. Finish: Match luminaire finish, unless otherwise indicated.
 6. Mounting Height: See drawings.
 7. Mounting: Install on concrete foundation, height as indicated on drawings, unless otherwise indicated.
 8. Construction: One piece with metal base covers to match pole material.
 9. Unless otherwise indicated, provide with the following features/accessories.
 - a. Top cap.
 - b. Hand hole.
 - c. Anchor bolts with leveling nuts or leveling shims.
 - d. Anchor base cover.
 - e. Provision for pole-mounted weatherproof GFI receptacle where indicated.
 - f. Brackets.
 - g. Hinged base.
 - h. Pole-top tenon.
- D. Metal Poles: Provide ground lug, accessible from hand hole or transformer base.

2.07 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2 inch size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4 inch size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's recommended installation procedures and instructions.
- C. Install luminaires securely, in neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Recessed Luminaires.
 - 1. Install trims tight to mounting surface with no visible light leakage.
 - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
 - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
 - 4. Install a minimum of four adjustable wing type hangers for each four-foot unit to secure non-lay-in type recessed luminaires.
- F. Suspended Luminaires.
 - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
 - 2. Install using suspension method indicated, with support lengths and accessories as required for specified mounting height.
 - 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with not more than 4 feet between supports.
 - 4. Install canopies tight to mounting surface.
 - 5. Unless otherwise indicated, support pendants from swivel hangers.
- G. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- H. Pole-Mounted Luminaires.
 - 1. Maintain following minimum clearances.
 - a. Comply with IEEE C2.
 - b. Comply with utility company requirements.
 - 2. Foundation-Mounted Poles.
 - a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 3000.
 - 1) Install anchor bolts plumb in accordance with template furnished by pole manufacturer.
 - 2) Position conduits to enter pole shaft.

- b. Install foundations plumb.
 - c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
 - d. Tighten anchor bolt nuts to manufacturer's recommended torque.
 - e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
 - f. Install anchor base covers or anchor bolt covers as indicated.
- 3. Embedded Poles: Install poles plumb as indicated.
- 4. Grounding.
 - a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
 - b. Provide supplementary ground rod electrode as specified in Section 26 0526 at each pole bonded to grounding system as indicated.
- 5. Install separate service conductors, 12 AWG copper, from each luminaire down to hand hole for connection to branch circuit conductors.
- 6. Install non-breakaway in-line fuse holders and fuses complying with Section 26 2813 in pole hand hole or transformer base for each ungrounded conductor.
- 7. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 26 2726 in designated poles.
- I. Mount Fuse Holders for Fluorescent Fixtures.
 - 1. In protected location within inside wiring channel or ballast enclosure.
 - 2. Accessible for convenient fuse changing.
- J. Mount Fuse Holders for LED Fixtures.
 - 1. In protected location within driver housing.
 - 2. Accessible for convenient fuse changing.
- K. Fluorescent Emergency Power Supply Units.
 - 1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire.
 - 2. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal ballast(s) in luminaire. Bypass local switches, contactors, or other lighting controls.
 - 3. Install lock-on device on branch circuit breaker serving units.
- L. Remote Ballasts: Install in accessible location as indicated or as required to complete installation, using conductors in accordance with manufacturer's recommendations, not exceeding manufacturer's recommended maximum conductor length to luminaire.
- M. Make wiring connections to branch circuit using building wire with insulation rating suitable for temperature conditions within luminaire.
- N. Install accessories furnished with each luminaire.
- O. Bond products and metal accessories to branch circuit equipment grounding conductor.
- P. Install lamps in each luminaire.
- Q. Connect circuit conductors to lighting panels and outdoor lighting control system.

3.04 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect-Engineer.
- D. Measure illumination levels at night with calibrated meters to verify conformance with performance requirements. Record test results in written report to be included with submittals.
 - 1. Test according to IESNA LM-64 (parking areas).

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect-Engineer. Secure locking fittings in place.
- B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect-Engineer.
- C. Adjust to align with building lines and with each other.

3.06 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of luminaires to Architect-Engineer, and correct deficiencies or make adjustments as directed.
- D. Just prior to Substantial Completion, replace lamps that have failed.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 27 0553
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 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.
- B. Division 27 Communications.
- C. Division 28 Electronic Safety and Security.

1.02 SUMMARY

- A. This Section includes identification for communications systems:
 - 1. Self-laminating labels
 - 2. Equipment cabinet labels

1.03 SUBMITTALS

- A. Comply with requirements of submittal section of Specifications.

1.04 QUALITY ASSURANCE

- A. Materials shall be new, complete with manufacturer's guarantee or warranty, and approved by Underwriters Laboratories, Inc.
- B. Materials shall also comply with applicable standards of National Electrical Manufacturers Association, Insulated Power Cable Engineers Association, National Safety Code, and American Institute of Electrical Engineers.
- C. Work shall be executed in workmanlike manner and present neat mechanical appearance when completed. Methods and techniques of installation shall be subject to approval of Architect-Engineer.
- D. Materials of same type or class shall be product of one manufacturer.
- E. Provide labeling in accordance with ANSI/EIA/TIA-606 requirements and in accordance with Owner and Technology Consultant.

1.05 PROJECT CONDITIONS

- A. Contractor shall be responsible for accurate location of his Work and for informing himself of nature and arrangement of materials, equipment, and construction to which his Work attaches or passes through.
- B. In general, label communication cables, equipment, cabinets, patch cord, data jacks, video jacks, cover plate, telecommunication rooms, MC/ER's video equipment, telephone system, etc.

PART 2 PRODUCTS

2.01 SELF-LAMINATING LABELS

- A. Provide self-laminating labels to meet TIA/EIA-606-A.
- B. Labeling shall be per Class 2 and/or Class 3 requirements.
- C. Approved Manufacturers.
 - 1. Panduit PUR5504XXU.
 - 2. Hubbell.
 - 3. Leviton.
 - 4. Hellermann Tyton.

2.02 EQUIPMENT CABINETS/RACKS IDENTIFICATION LABELS

- A. Provide engraved, laminated acrylic label.
- B. Secure to equipment with screws.
- C. White letters on black background.

- D. Minimum letter height: 1/2-inch.

PART 3 EXECUTION

3.01 IDENTIFICATION

- A. Equipment Identification.
1. Provide nameplates on equipment such as Telecommunication Rooms (TR), Main Cross Connect/Equipment Room (MC/ER), patch panels, CPU, and the like.
 2. Lettering shall include name of equipment, specific unit number, and other instructions that are applicable.
 3. Nameplates: Laminated phenolic with black surface and white core. Use 1/16 inch thick material for plates up to 2 inches by 4 inches. For larger sizes use 1/8 inch thick material. Lettering of names should correspond to nomenclature specified for apparatus, corresponding with drawings, details, schedules, charts, wiring diagrams, and operating instructions, as approved by Architect-Engineer.
 4. Lettering: Condensed Gothic. Space between lines: Equal to width of letters. Use 1/4 inch minimum height letters which occupy four to 1 inch. Increase letter size to 3/4 inch on largest plates.
 5. Attach directly to apparatus in manner approved by Architect-Engineer.
- B. Labeling.
1. Label each cable (voice, video and data), video outlet, telephone and data jack at each patch panel and jack outlet clearly, neatly, and completely, including "Spares." Not subject to moisture or fading, self-adhesive, and typewritten. Type room label above patch panel port location to allow end user ease in identification of patch panel locations. Label patch panels with large 1/2-inch letter to designate patch panel I.D. (A-Z). This letter will correspond to faceplate labeling at station faceplate. (Example: TR-B1.1 A22 where closet "TR-B1.1" and the patch panel port "A22" number are both identified).
 2. Use following format to identify plate/connectors.
 - a. Individual jack designations shall begin at main entry point of room or space, and continue in clockwise rotation. Use following labeling codes:
 - 1) C - communication.
 - 2) V - video.
 - 3) L - video control.
 - 4) A - audio (left-white, right-red).
 - 5) I - input.
 - 6) O - output.
 - 7) AI - audio input, AL - audio left, AR - audio right.
 - 8) AO - audio output.
 - 9) VI - video input.
 - 10) VO - video output.
 - 11) VP - video projector.
 - 12) IWB - Interactive white board.
 - 13) FO - fiber optic.
 - 14) F - coax cable.
 - 15) S - security.
 - 16) DC - door contact.
 - 17) PT - power transfer.
 - 18) MD - motion detectors.
 - 19) REQ - required for exit.
 - 20) SS - sound system.
 - 21) WAP - wireless access points.
 - 22) CAM - camera.
 3. Submit labeling scheme with system submittal drawings and approved prior to termination of devices. Submit detailed drawing or sample plate with connectors installed to depict intended labeling scheme.

4. Apply label within 6 inches from end of each of cables.
 5. Terminate cabling at patch panels in numerical order to provide logical pattern that will provide end user greatest ease in system administration.
 6. For fiber cabling, apply labels at patch panels in space that is provided. Label shall include room and location where fiber is routed to or from.
 7. Clean and level.
 8. Final labels should reflect Owner's room designation scheme, which may not match construction drawing numbers. Form final room number scheme with Architect-Engineer prior to labeling faceplate and patch panels. If final room numbers are not available at time of cable installation, architectural numbers shall be permitted for cable labeling only. If architectural numbers are used, submit cross reference sheet in spreadsheet format. This may require that Contractor re-label patch panels to match final room numbers.
 9. Refer to drawings for patch panel and faceplate labeling detail.
- C. Other Items
1. Provide identification as required in other subsections of these Specifications and as denoted on Drawings.
- D. It is responsibility of Cabling Contractor to clearly and logically label terminal blocks, cables, and equipment (with length and room number).
- E. Labels: Clearly typed and appear at cable ends within 6 inches of jack or patch panel termination on outer jacket, on faceplate of station jacks, and on patch panels. Number patch cables 1 through X within 1/2 inch of each termination. Label station runs indicating room number of station and its MC/ER and TR termination point as well as unique identifier. (Handwritten labeling is not allowed.)
- F. Tag video coax cable with distance at MC/ER and TR end as well as regular identifier. Identify backbone cables with identifier that identifies where each cable end is terminated.
- G. Provide labeling for following items with room name and room number:
1. Video projector and video projector remote.
 2. Television and television remote.
 3. Classroom sound system.
 4. Wireless keyboard and mouse.
 5. Telephones.
 6. Cameras.
 7. Security devices.
 8. Miscellaneous equipment, etc.

END OF SECTION

SECTION 28 0533
RACEWAYS AND BOXES FOR SECURITY DEVICES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 07 8413 - Through-Penetration Firestop Systems.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0534 - Conduit.
- D. Section 26 0537 - Boxes.
- E. Section 26 0553 - Identification for Electrical Systems.

1.02 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2005.
- D. NECA 1 - Standard Practices for Good Workmanship in Electrical Contracting; National Electrical Contractors Association; 2010.
- E. NECA 101 - Standard for Installing Steel Conduit (Rigid, IMC, EMT); National Electrical Contractors Association; 2006.
- F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2007.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. No product submittals required.
- C. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches.

1.04 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept conduit on site. Inspect for damage.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.06 SYSTEM DESCRIPTION

- A. Raceways and Boxes For.
 - 1. Access control system.
 - 2. Video surveillance system.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

- A. Conduit Stub-Outs.
 - 1. From wall outlet box to 6 inches above lay-in type room ceiling space. Stub-out conduit to corridor ceiling space if room is scheduled to have gypsum ceiling, unless shown otherwise.
 - 2. Terminate with insulated bushing.
 - 3. Include pulling wire or heavy nylon pulling cord for conduit more than 25 feet long.

4. Access control stub-outs, 3/4 inch.
 5. Video surveillance stub-outs, 3/4 inch.
- B. Outlet Boxes.
1. Appropriate size extension ring.
 2. Match cover plate with wiring device cover.
 3. Verify outlet box size with manufacturer/Owner.
 4. Access control: 2-gang box with single-gang mud ring.
 5. Video surveillance: Single-gang box.
- C. Conduit Size: Comply with NFPA 70 unless larger size is indicated on Contract Documents.
1. Minimum Size: 3/4 inch unless otherwise specified.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Tag ends of conduit with system identification letters.
- B. Test conduit for clear passage.
- C. Mark inside of outlet boxes with system identification letters using permanent ink identifying system.

END OF SECTION

SECTION 28 3100
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.
- B. Section 21 1000 - Water-Based Fire Suppression Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.
- C. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; current edition; (ADA Standards for Accessible Design).
- B. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (Cor 1, 2012).
- C. NFPA 70 - National Electrical Code; 2008.
- D. NFPA 72 - National Fire Alarm Code and Signaling Code; 2010.
- E. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; 2009.
- F. UL 864 - Control Units and Accessories for Fire Alarm Systems; 2009.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Evidence of designer qualifications.
- C. Design Documents: Submit information required for plan review and permitting by authorities having jurisdiction, including but not limited to, floor plans, riser diagrams, and description of operation.
 - 1. Copy (if any) of list of data required by authority having jurisdiction.
 - 2. NFPA 72 "Record of Completion", filled out to extent known at the time.
 - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
 - 4. System zone boundaries and interfaces to fire safety systems.
 - 5. Location of components, circuits, and raceways; mark components with identifiers used in control unit programming.
 - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
 - 7. List of devices on each signaling line circuit, with spare capacity indicated.
 - 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
 - 9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
 - 10. Certification by either manufacturer of control unit or by manufacturer of each other component that components are compatible with control unit.
 - 11. Certification by manufacturer of control unit that system design complies with contract documents.
 - 12. Certification by Contractor that system design complies with contract documents.
- D. Evidence of installer qualifications.

- E. Inspection and Test Reports.
 - 1. Submit inspection and test plan prior to closeout demonstration.
 - 2. Submit documentation of satisfactory inspections and tests.
 - 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- F. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration.
 - 1. Complete set of specified design documents, as approved by authority having jurisdiction.
 - 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
 - 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
 - 4. List of recommended spare parts, tools, and instruments for testing.
 - 5. Replacement parts list with current prices, and source of supply.
 - 6. Detailed troubleshooting guide and large scale input/output matrix.
 - 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
 - 8. Detailed but easy to read explanation of procedures to be taken by nontechnical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- G. Project Record Documents: See Section 01 7800 for additional requirements; have one set available during closeout demonstration:
 - 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
 - 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
 - 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- H. Closeout Documents.
 - 1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
 - 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm installation Contractor, with experience designing fire alarm systems in jurisdictional area of authorities having jurisdiction.
- B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of specified type and providing contract maintenance service as regular part of their business.
 - 1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
 - 2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
 - 3. Installer: NICET level II, III or IV (2, 3 or 4) certified fire alarm technician; furnish name and address.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
- C. Provide installer's warranty that installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Alarm System - Basis of Design: SimplexGrinnell: www.simplexgrinnell.com.
- B. Auburn University has a sole source contract with SimplexGrinnell for fire alarm systems.
- C. Fire Alarm Control Units.
 - 1. SimplexGrinnell: www.simplexgrinnell.com.
 - 2. Provide all control units made by the same manufacturer.
- D. Initiating Devices and Notification Appliances.
 - 1. SimplexGrinnell: www.simplexgrinnell.com.
 - 2. Same manufacturer as control units.

2.02 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
 - 1. Provide necessary components, regardless of whether shown in contract documents or not.
 - 2. Protected Premises: Entire building shown on drawings.
 - 3. Addressable System.
 - a. Complete, noncoded, addressable, microprocessor-based.
 - b. Allow for loading and editing special instructions and operating sequences.
 - c. On-site programming.
 - d. Software operations stored in nonvolatile programmable memory
 - e. Loss of primary and secondary power shall not erase instructions stored in memory.
 - f. Capability of recalling alarms and trouble conditions in chronological order to create event history.
 - g. Assign unique address to initiating devices, alarm, and supervisory.
 - h. In alarm condition, system capable of identifying activated devices.
 - i. Allow any device on initiation circuit to be programmed as alarm or supervisory and assigned to any alarm zone.
 - j. Analog initiating devices communicate value of measurable, such as smoke density or heat, to control panel for alarm determination and sensitivity adjustment.
 - 4. Comply with following; where requirements conflict, order of precedence of requirements is as listed.
 - a. Americans With Disabilities Act (ADA).
 - b. Requirements of State Fire Marshal.
 - c. Requirements of local authority having jurisdiction.
 - d. Applicable local codes.
 - e. Contract documents (drawings and specifications).
 - f. NFPA 101.
 - g. NFPA 72; where word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
 - 5. Evacuation Alarm: Single smoke zone; general evacuation of entire premises.
 - 6. Fire Command Center: coordinate location with University.
 - 7. Master Control Unit (Panel): New, located as shown on drawings.
- B. Circuits.
 - 1. Initiating Device Circuits (IDC): Class B, Style A.
 - 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
 - 3. Notification Appliance Circuits (NAC): Class B, Style W.
- C. Spare Capacity.
 - 1. Initiating Device Circuits: Minimum 25 percent spare capacity.
 - 2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
 - 3. Speaker Amplifiers: Minimum 25 percent spare capacity.

4. Master Control Unit: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.
- D. Power Sources.
1. Primary: Dedicated branch circuits of the facility power distribution system.
 2. Secondary: Storage batteries.
 3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
 4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 FIRE SAFETY SYSTEMS INTERFACES

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for following.
1. Sprinkler water control valves.
 2. Dry-pipe sprinkler system pressure.
 3. Dry-pipe sprinkler valve room low temperature.
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for following.
1. Fire alarm pull station.
 2. Sprinkler water flow.
 3. Duct smoke detectors.
- C. HVAC.
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.
- D. Doors.
1. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from.

2.04 COMPONENTS

- A. General.
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for purpose intended.
- C. Master Control Unit: As specified for Basis of Design above, or equivalent.
- D. Initiating Devices.
1. Double Action Manual Pull Stations:
 - a. Shall be non-breakglass, address reporting type.
 - b. Station front shall be constructed of a durable material such as cast or extruded metal or high impact plastic. Stations shall be semi-flush type.
 - c. Stations shall be of double action pull down type with suitable operating instructions provided on front in raised or depressed letters, and clearly labeled "FIRE."
 - d. Operating handles shall be constructed of a durable material. On operation, the lever shall lock in alarm position and remain so until reset. A key or special tool shall be required to gain front access for resetting, or conducting tests and drills. Provide two such tools to the owner.
 - e. Unless otherwise specified, all exposed parts shall be red in color and have a smooth, hard, durable finish.
 2. Photoelectric Smoke Detectors:
 - a. Smoke detectors shall operate as two wire detectors and have an LED output upon alarm. The detector shall be non-polarized. Voltage and RF transient suppression techniques shall be employed to minimize false alarm potential. A smoke signal verification feature shall be used for additional detector stability.
 - b. Smoke detectors shall be photoelectric type and UL listed for use with the fire alarm control unit being furnished.

- c. Smoke detectors shall be addressable type complying with applicable UL Standards for system type detectors. Smoke detectors shall be installed in accordance with the manufacturer's recommendations and NFPA 72.
 - d. Detectors shall have an indication lamp to denote an alarm condition. Provide remote indicator lamps and identification plates where detectors are concealed from view. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position.
 - e. Photoelectric detectors shall be factory calibrated and readily field adjustable. The sensitivity of any photoelectric detector shall be factory set at 3.0 plus or minus 0.25 percent obscuration per foot.
 - f. Detectors shall provide a visual trouble indication if they drift out of sensitivity range or fail internal diagnostics. Detectors shall also provide visual indication of sensitivity level upon testing. Detectors, along with the fire alarm control units shall be UL listed for testing the sensitivity of the detectors.
3. Photoelectric Duct Smoke Detectors:
- a. Duct smoke detectors shall be of the photoelectric, light-refraction type with the detection chamber directly in the air stream of the duct.
 - b. Detection shall occur with 1% to 3% smoke obscuration in the detection chamber. The detectors shall lock in on an alarm condition.
 - c. A removable "Normal-Reset-Test" key switch shall be provided on each detector to control its operation.
 - d. The detectors shall have SPST alarm contacts and 3 SPDT contacts. Contacts shall be rated at 10 amperes, resistive load.
 - e. Provide remote indicator lamps and identification plates where detectors are concealed from view. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position.
4. Heat Detectors:
- a. Heat detectors shall be low profile with normally open alarm contacts. They shall be combination rate of rise, and/or 135 Degree fixed temperature devices.
 - b. Heat detectors shall be of the addressable restorable rate compensated fixed-temperature spot type.
 - c. Detectors shall have a minimum smooth ceiling rating of 2,500 square feet (230 square meters).
 - d. Ordinary temperature (135 degrees F (57 degrees C)) heat detectors shall be utilized in elevator shafts and elevator mechanical rooms. Intermediate temperature rated (200 degrees F (93 degrees C)) heat detectors shall be utilized in all other areas.
 - e. Provide a remote indicator lamp, key test station and identification nameplate (e.g. "Heat Detector - Elevator P-) for each elevator group. Locate key test station in plain view on elevator machine room wall.
5. Water Flow and Pressure Switches:
- a. Wet pipe water flow switches and dry pipe alarm pressure switches for sprinkler systems shall be connected to the fire alarm system by way of an address reporting interface device.
 - b. All new water flow switches shall be of a single manufacturer and series and non-accumulative retard type. // See Section 21 12 00, FIRE-SUPPRESSION STANDPIPES and Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS for new switches added. Connect all switches shown on the approved shop drawings.//
 - c. All new switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds. Timing shall be recorded and documented during testing.
6. Addressable Interface Devices:
- a. Shall have unique addresses that reports directly to the building fire alarm panel.
 - b. Shall be configurable to monitor normally open or normally closed devices for both alarm and trouble conditions.

- c. Shall have terminal designations clearly differentiating between the circuit to which they are reporting from and the device that they are monitoring.
 - d. Shall be UL listed for fire alarm use and compatibility with the panel to which they are connected.
 - e. Shall be mounted in weatherproof housings if mounted exterior to a building.
- E. Notification Appliances.
- 1. Horns:
 - a. Shall be electric, utilizing solid state electronic technology operating on a nominal 24 VDC.
 - b. Horn rated for 21-28VDC and 35ma.
 - c. Shall be a minimum nominal rating of 90 dBA at 10 feet (3,000 mm).
 - d. Mount on removable adapter plates on conduit boxes.
 - e. Horns located outdoors shall be of weatherproof type with metal housing and protective grille.
 - f. Each horn circuit shall have a minimum of 20 percent spare capacity.
 - 2. Horn/Strobe:
 - a. The horn/strobe light combination shall consist of a vibrating horn and visual indicating device. Both horn and light shall operate at the same time except when they shall be zoned separately. The lamp assembly is to be shock mounted to prevent filament destruction due to vibration from the horn.
 - b. This device shall meet all "ADA" requirements.
 - 3. Strobes:
 - a. Xenon flash tube type with a clear lens, minimum 15 candela in toilet rooms and 75 candela in all other areas with a flash rate of 1 HZ. Strobes shall be synchronized where required by the National Fire Alarm Code (NFPA 72).
 - b. Xenon Flasher rated for 500 hour life, 24VDC, and 70ma.
 - c. Backplate shall be red with 1/2 inch (13 mm) permanent red letters. Lettering to read "Fire", be oriented on the wall or ceiling properly, and be visible from all viewing directions.
 - d. Each strobe circuit shall have a minimum of 20 percent spare capacity.
 - e. Strobes may be combined with the audible notification appliances specified herein.
 - f. This device shall meet all "ADA" requirements.
- F. Supervisory Devices:
- 1. Sprinkler and Standpipe System Supervisory Switches:
 - a. Each sprinkler system water supply control valve, riser valve or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
 - b. PIV (post indicator valve) or main gate valve shall be equipped with a supervisory switch.
 - c. Valve supervisory switches shall be connected to the fire alarm system by way of address reporting interface device. // See Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS for new switches to be added. Connect tamper switches for all control valves shown on the approved shop drawings. //
 - d. The mechanism shall be contained in a weatherproof die-cast aluminum housing that shall provide a 3/4 inch (19 mm) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
 - e. The entire installed assembly shall be tamper-proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting.
 - f. Where dry-pipe sprinkler systems are installed, high and low air pressure switches shall be provided and monitored by way of an address reporting interface devices.
 - g. Fire supervisory signals required by NFPA 20 and monitored by the pump controller shall be provided and monitored by way of address reporting interface devices for the fire pump located// indicate location.

- G. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.
- H. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
- I. Locks and Keys: Deliver keys to Owner.
- J. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
 - 1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
 - 2. Provide one for each control unit where operations are to be performed.
 - 3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
 - 4. Provide extra copy with operation and maintenance data submittal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and contract documents.
- B. Install wiring in conduit. Conduit must be red throughout.
- C. Conceal wiring, conduit, boxes, and supports where installed in finished areas.
- D. Obtain Owner's approval of locations of devices, before installation.
- E. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide services of installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required.
- E. Provide tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.03 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
 - 1. Be prepared to conduct any of required tests.
 - 2. Have at least one copy of operation and maintenance data, preliminary copy of Project Record Drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
 - 3. Have authorized technical representative of control unit manufacturer present during demonstration.
 - 4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
 - 5. Repeat demonstration until successful.

END OF SECTION

SECTION 32 3113
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes chain-link fences and swing gates.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each polymer-coated product and for each color and texture specified, in 6-inch lengths for components and on full-sized units for accessories.
- D. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Product Certificates: For each type of chain-link fence and gate, from manufacturer.
- F. Product Test Reports: For framing strength according to ASTM F 1043.
- G. Operation and maintenance data.
- H. Sample of special warranty.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle. Comply with CLFMI Product Manual and with requirements indicated below:
 - 1. Fabric Height: 6 feet.
 - 2. Steel Wire Fabric: Wire with a steel core wire of 0.148 inch. (9 Gauge)
 - a. Mesh Size: 2 inch.
 - b. Polymer-Coated Fabric: ASTM F 668, Class 2b over zinc-coated steel wire.
 - 1) Color: Black, complying with ASTM F 934.
 - 3. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
 - 1. Fence Height: 72 inches.
 - 2. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.
 - a. Line Post: 1.9 inches in diameter.
 - b. End, Corner and Pull Post: 2.875 inches in diameter.
 - c. Top Rail, Brace Rail and Gate Frames: 1.66" in diameter.

3. Metallic Coating for Steel Framing:
 - a. Type A zinc coating.
 - b. Type B zinc with organic overcoat.
 - c. External, Type B zinc with organic overcoat and internal, Type D zinc-pigmented coating.
 - d. Type C, Zn-5-Al-MM alloy coating.
 - e. Coatings: Any coating above.
4. Polymer coating over metallic coating.
 - a. Color: Black, complying with ASTM F 934.
 - b. Optional Supplemental Color Coating: 3 mil polyester as per ASTM F1043, Section 7.3.

2.3 TENSION WIRE

- A. Polymer-Coated Steel Wire: 0.192-inch- (6 ga.) finished diameter, tension wire complying with ASTM F 1664, Class 1 over zinc-coated steel wire.
 1. Color: Black, complying with ASTM F 934.

2.4 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single and double swing gate types.
 1. Gate Leaf Width: As specified
 2. Gate Fabric Height: 6 feet
- B. Frame Corner Construction: Welded or assembled with corner fittings.
- C. Hardware:
 1. Hinges: 90-degree inward and outward swing.
 2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
 3. Padlock and Chain: Padlock with Best 7-PIN IC Core to meet Auburn University specifications.
 4. Lock: Best 7-PIN IC Core.

2.5 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Finish:
 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.
 - a. Polymer coating over metallic coating.

2.6 PRIVACY SLATS

- A. Material: PDS Winged Slats or approved equal
- B. Color: As selected by Owner from manufacturer's full range.

2.7 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, non-gaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
- D. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
- E. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- F. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Concealed Concrete: Top 2 inches below grade to allow covering with surface material.
- G. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- H. Line Posts: Space line posts uniformly at 10 feet o.c.
- I. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Provide horizontal tension wire at the following locations:
 1. Extended along bottom of fence fabric.
- J. Privacy Slats: Install slats in direction indicated, as per mfg's instructions.
 1. Vertically.
- K. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- L. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

END OF SECTION

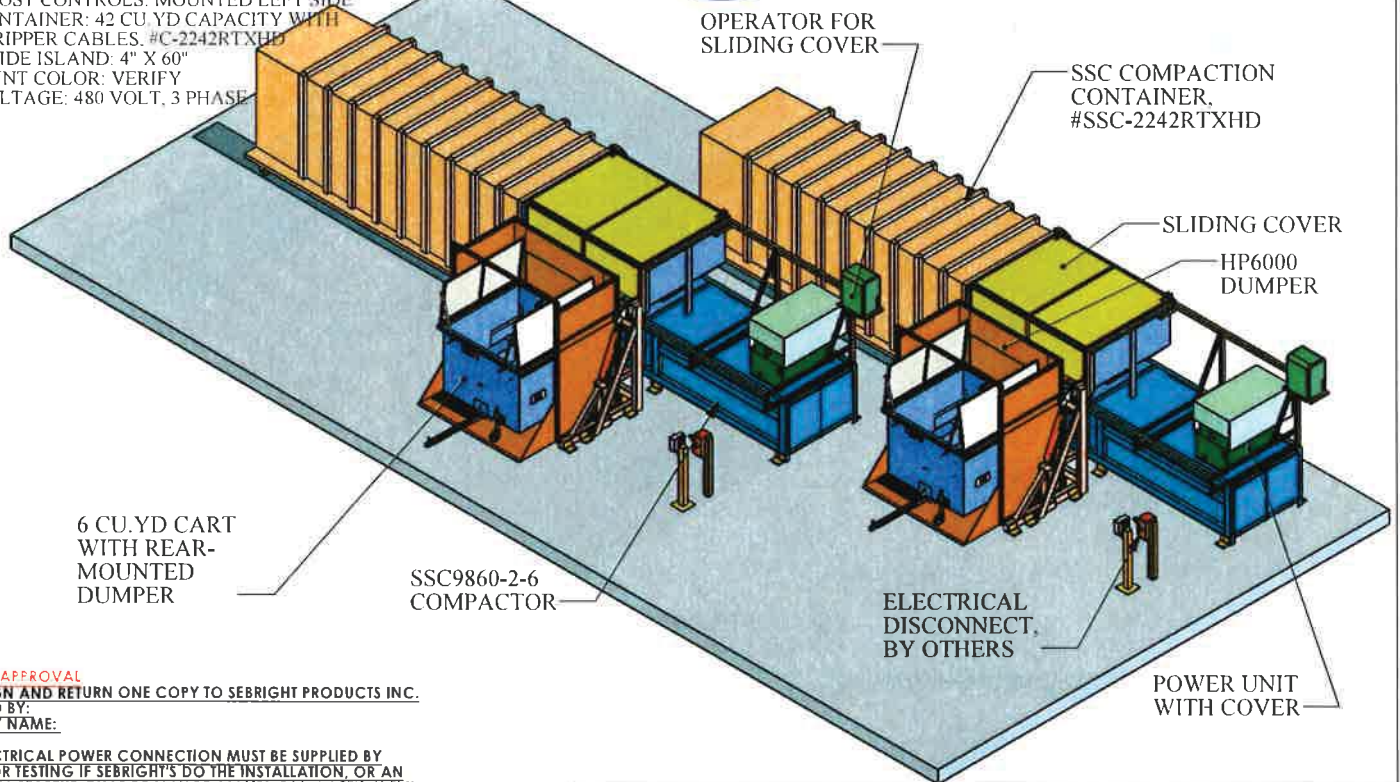
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NOTES:

- 1 COMPACTOR MODEL: SSC9860-2-6
- 2 DUMPER MODEL: HP6000
- 3 HOPPER: LEFT SIDE LOAD, 9'-0" WIDE
- 4 SLIDING HOPPER COVER INTERLOCKED SO
- 5 DUMPER WON'T OPERATE WHEN COVER IS CLOSED
- 6 ELECTRIC OPERATOR TO ACTUATE COVER
- 7 DUMP CART: (1) 6 CU. YD WITH DUAL TOP LID
- 8 CART MOUNTED DUMPER: BS300, (ELECTRIC)
- 9 POWER UNIT: 93 GALLON, 30 HORSEPOWER, WITH COVER
- 10 BOOST CONTROLS: MOUNTED LEFT SIDE
- 11 CONTAINER: 42 CU. YD CAPACITY WITH
- 12 STRIPPER CABLES, #C-2242RTXHD
- 13 GUIDE ISLAND: 4" X 60"
- 14 PAINT COLOR: VERIFY
- 15 VOLTAGE: 480 VOLT, 3 PHASE

REV	DESCRIPTION	DATE

Donny Allison
DAB 4/21/14



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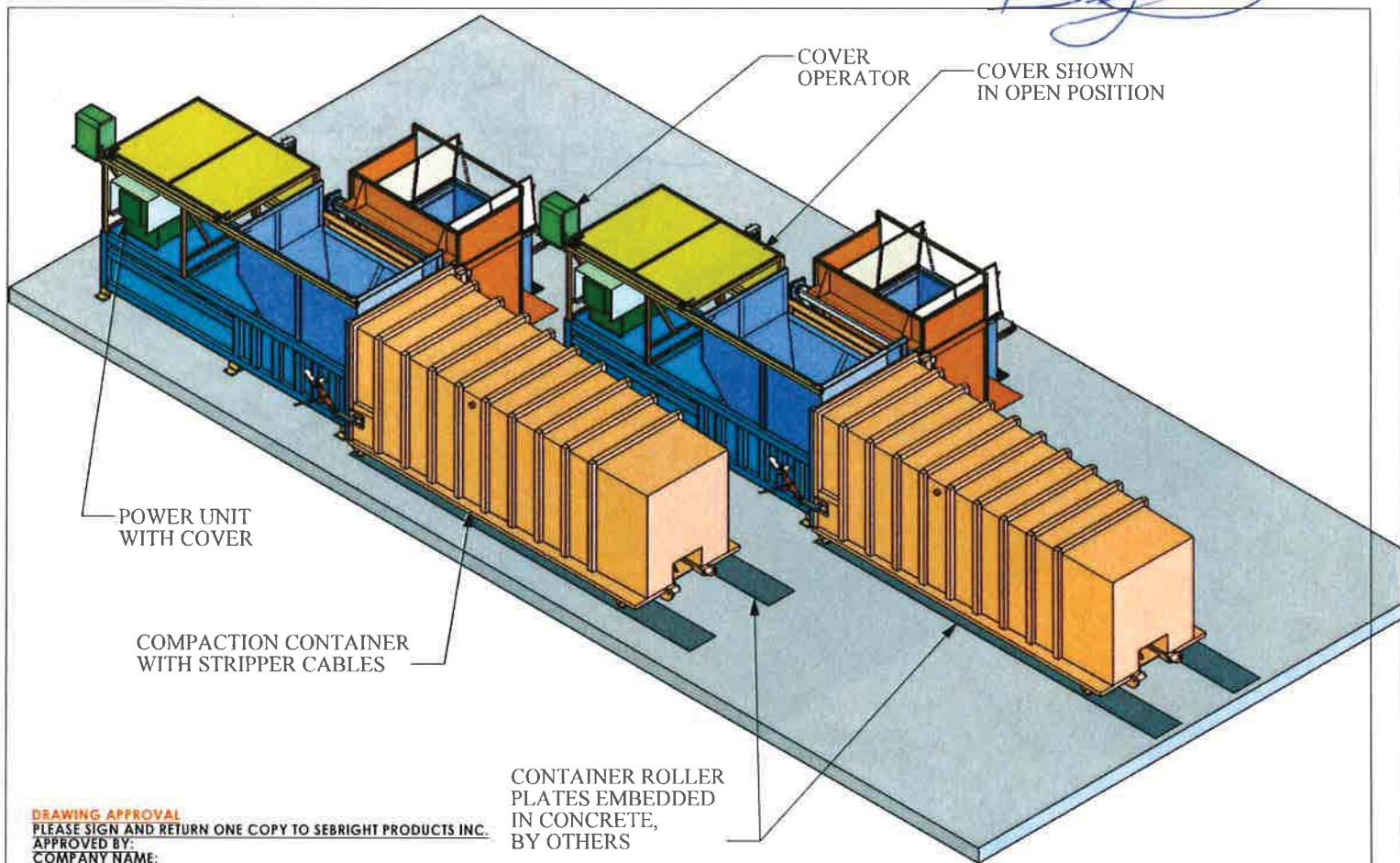
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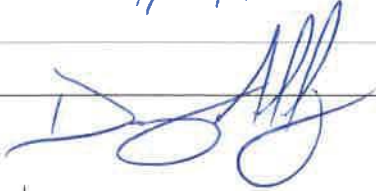
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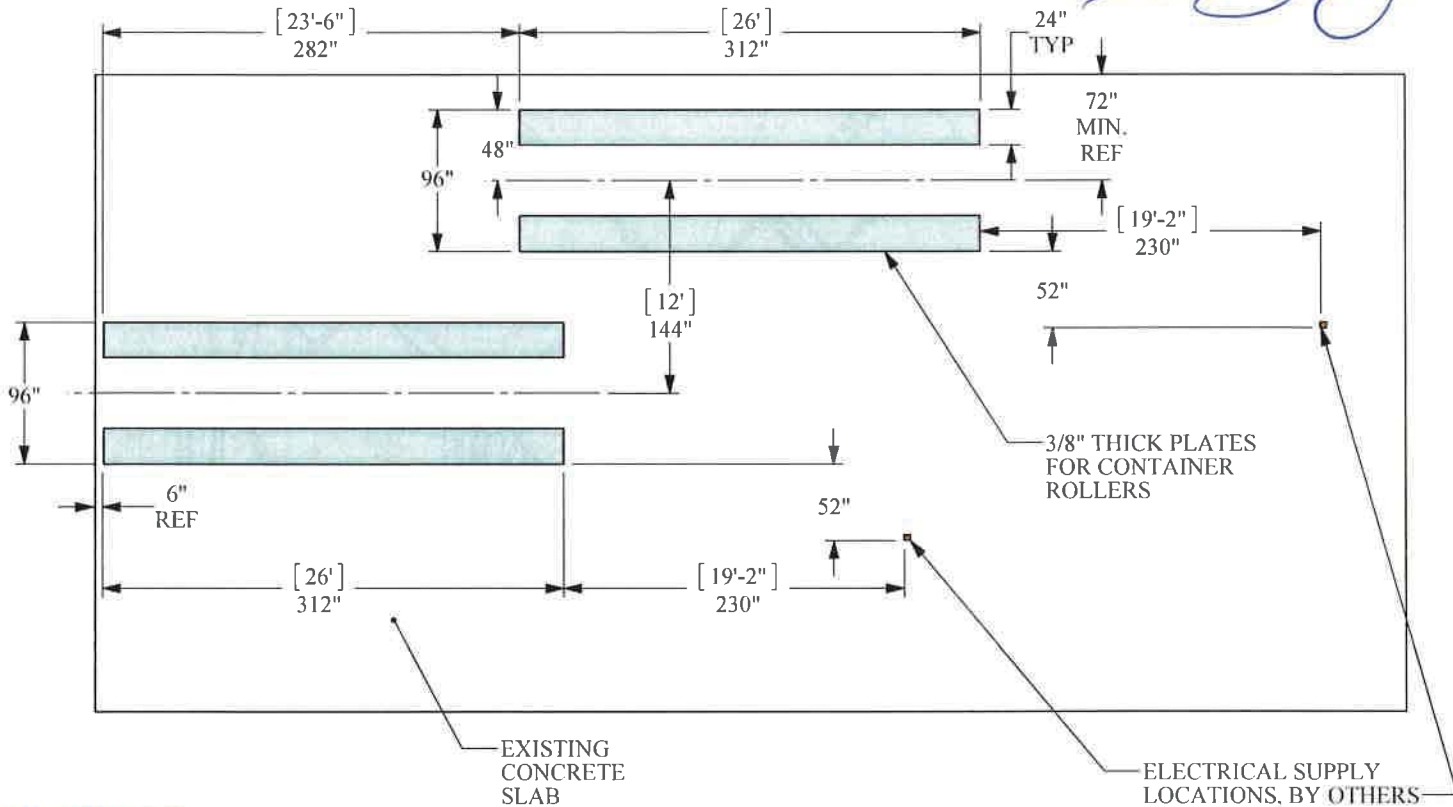
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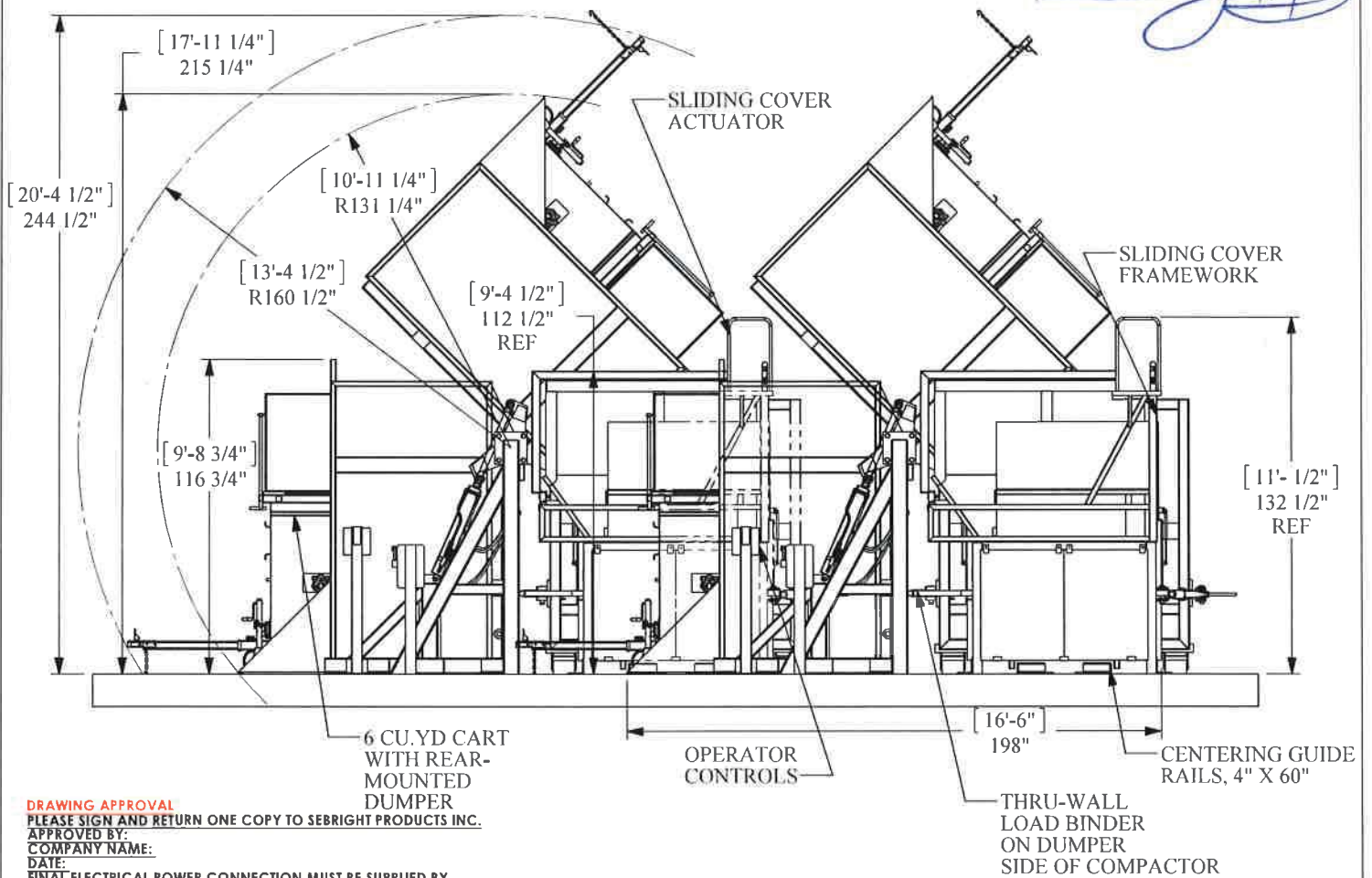
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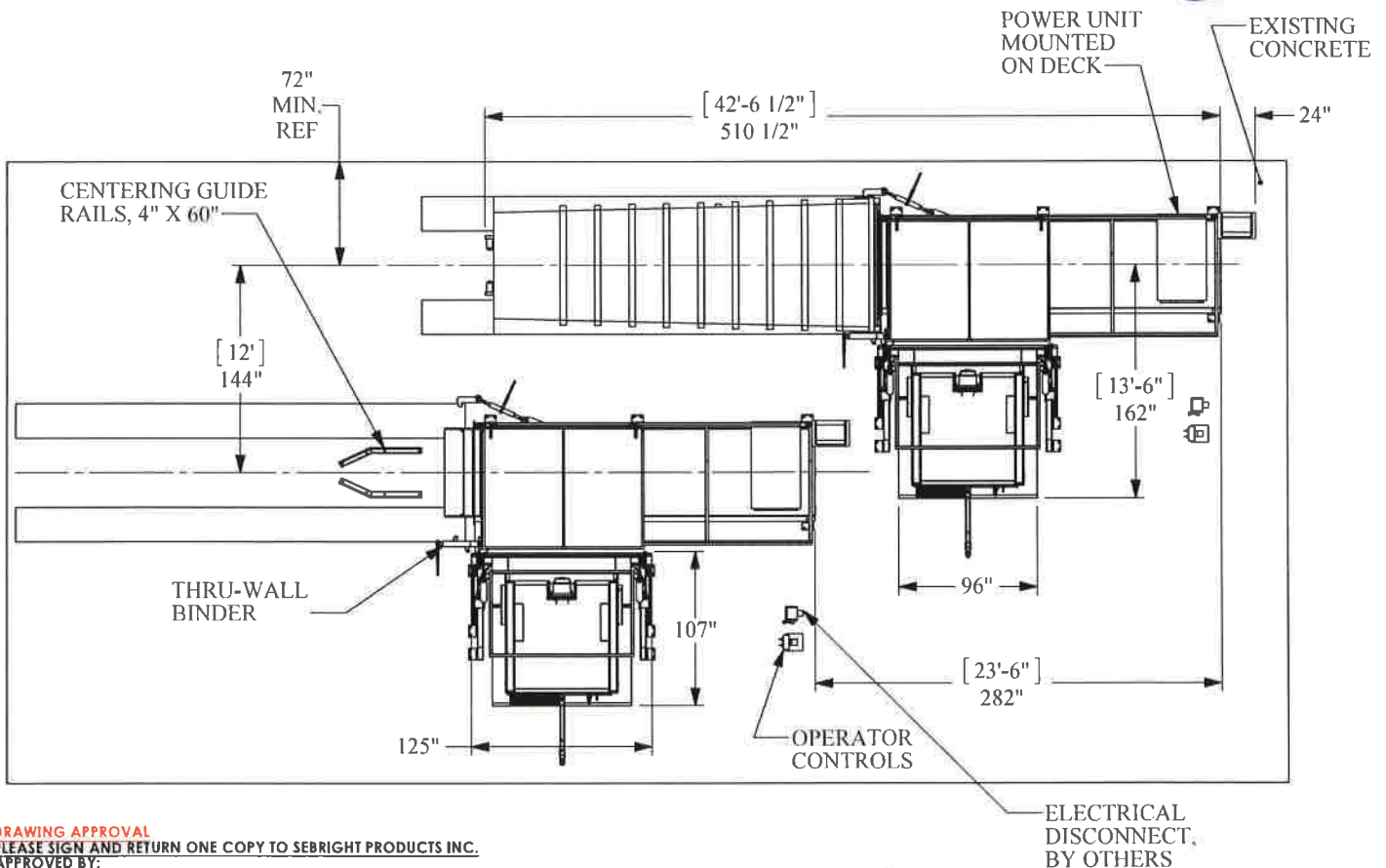


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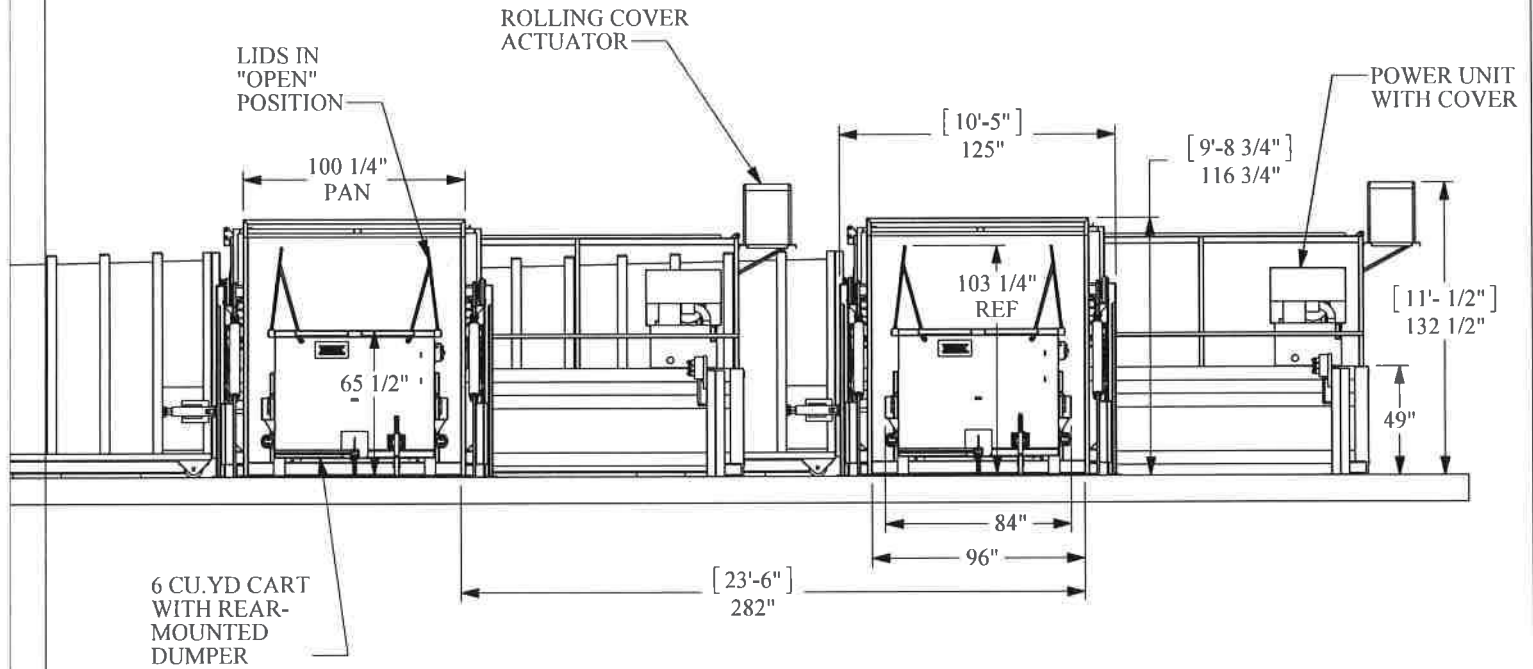
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DATE: 4/8/2014 1:28 PM				DRAWN BY: 4-3-14				CHECKED BY: A				APPROVED BY: BB				SHEET 5 OF 9				TITLE: SALES LAYOUT FOR DIETER KRETSCHY			
SCALE: 1/8" = 1'-0"				PROJECT NO: 140311079				REV: 10646				DATE: 4/8/2014				BY: 10646				10646			

4/8/2014 1:29 PM

4/21/14

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 APPROVED BY:
 COMPANY NAME:
 DATE:
 FINAL ELECTRICAL POWER CONNECTION MUST BE SUPPLIED BY
 OTHERS FOR TESTING IF SEBRIGHT'S DO THE INSTALLATION, OR AN
 ADDITIONAL STARTUP CHARGE MAY BE APPLIED FOR A RETURN TRIP.

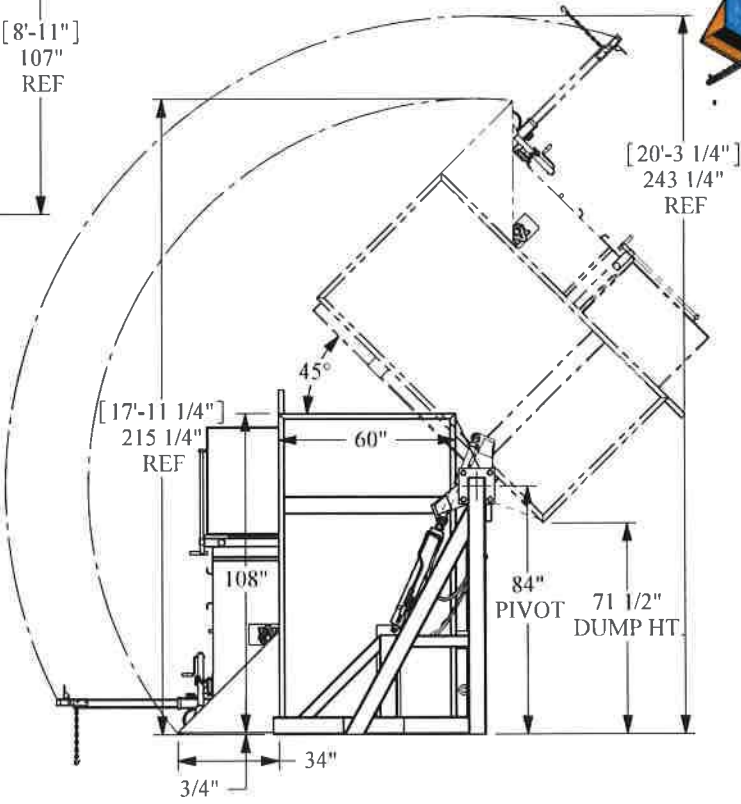
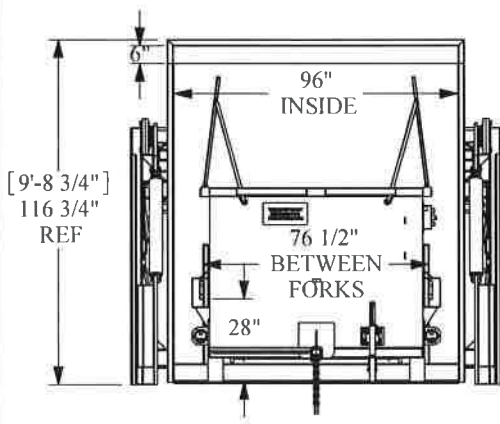
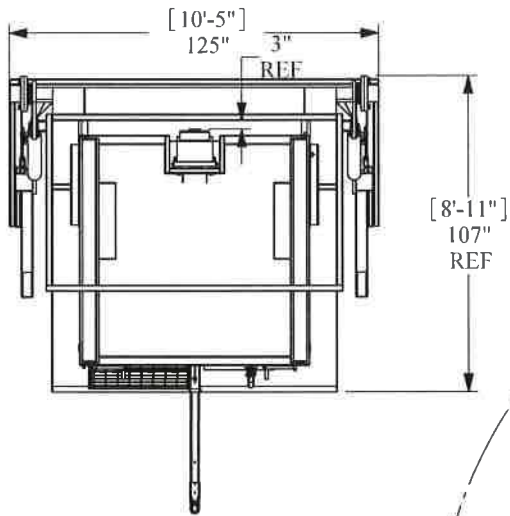
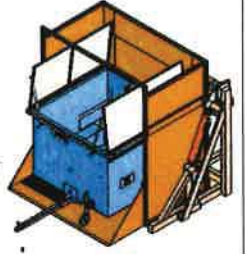
DATE: 4/8/2014 1:28 PM	REV: 4-1-14	REVISED BY: A	DESIGNED BY: BB	SHEET 6 OF 9	TITLE: SALES LAYOUT FOR DIETER KRETSCHY			
DRAWING LEGEND: CONFIDENTIAL					SEBRIGHT PRODUCTS INC.			
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TOLERANCE (UNLESS SPECIFIED): FRACTIONS: ± 1/16" DECIMALS: ± 0.005 ANGLES: ± 0°30'					AUBURN UNIVERSITY, AUBURN, AL			
					SHEET 6 OF 9			
					14031107Y 10646			

4/21/14

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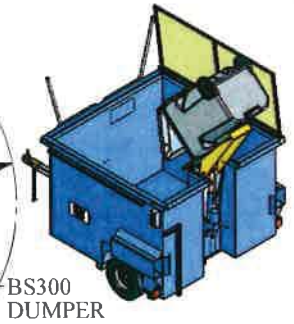
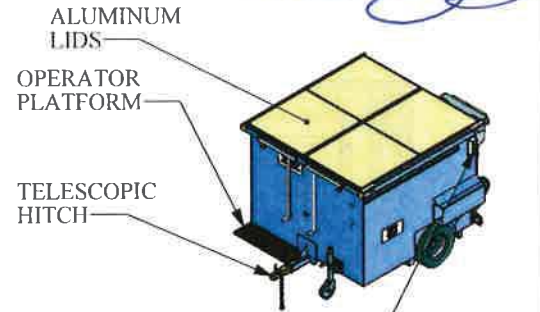
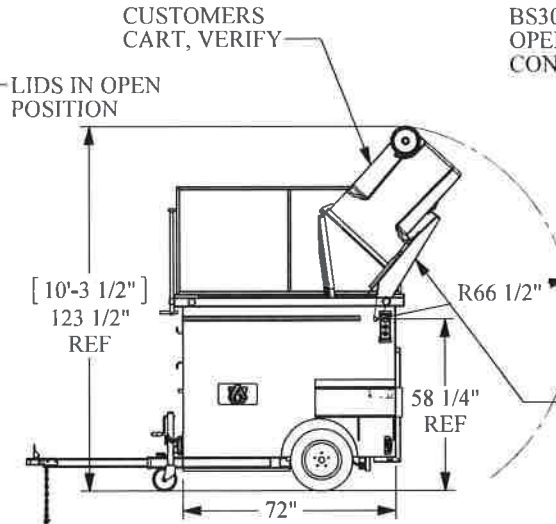
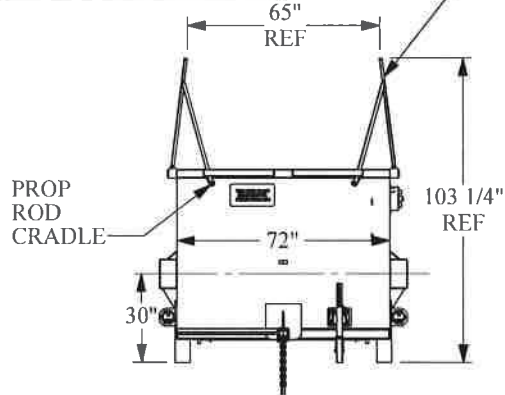
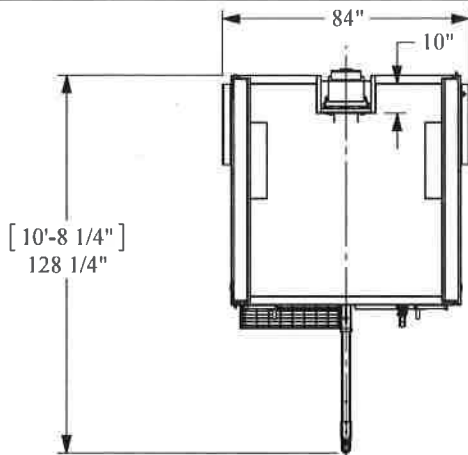
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DATE: 4/8/2014 1:28 PM	DATE: 4-3-14	DRAWN: A	DESIGNED: BB	SHEET 7 OF 9	TITLE: HP6000 DUMPER ASS'Y	BY: AUBURN UNIVERSITY, AUBURN, AL
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ADDITIONAL STARTUP CHARGE MAY BE APPLIED FOR A RETURN TRIP.

6 CU.YD CART ASS'Y WITH BS300 DUMPER

SEBRIGHT PRODUCTS INC.
127 N. WATER ST. HOPKINS, MI 49328
PH 269-793-7183 www.sebrightproducts.com



EX OTHERS USE: AUBURN UNIVERSITY, AUBURN, AL
DATE: 4-8-14
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140311079 10646

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4/8/2014 1:28 PM
REV: 1
4-8-14
REV: 1
A
REV: 1
BB
SHEET 8 OF 9

TO TOLERANCE: (UNLESS SPECIFIED)
FRACTIONS: 1/16"
ANGLES: 2.0025°
2.0025°

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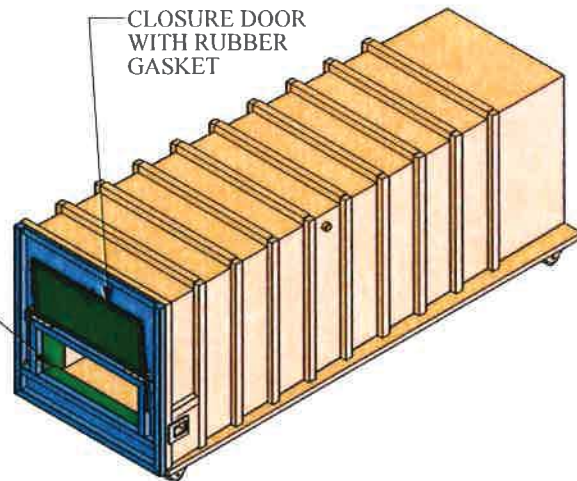
PLEASE SIGN AND RETURN ONE COPY TO SEBRIGHT PRODUCTS INC.

APPROVED BY:

COMPANY NAME:

DATE:

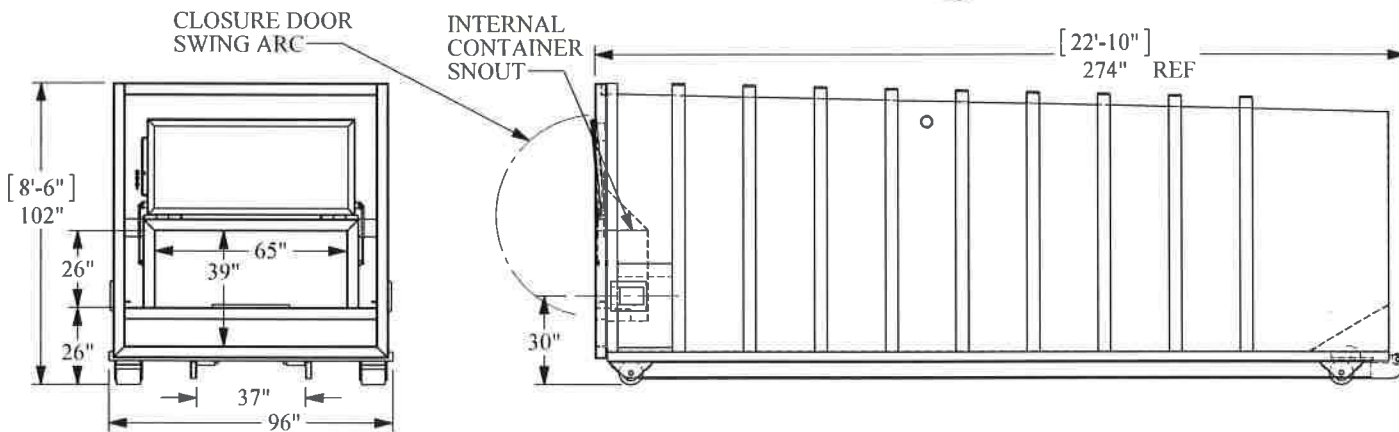
FINAL ELECTRICAL POWER CONNECTION MUST BE SUPPLIED BY OTHERS FOR TESTING IF SEBRIGHT'S DO THE INSTALLATION. OR AN ADDITIONAL STARTUP CHARGE MAY BE APPLIED FOR A RETURN TRIP.



CLOSURE DOOR WITH RUBBER GASKET

INTERNAL SNOOT

NOTE:
STRIPPER CABLES REQUIRED ON INSIDE OF CONTAINER, NOT SHOWN



DATE: 4/8/2014 1:28 PM	BY: 4-3-14	REV: A	BB	SHEET 9 OF 9	SSC CONTAINER STANDARD OPTIONS SEBRIGHT PRODUCTS INC. 127 N. WATER ST. HOPKINS, MI 49328 PH 269-793-7183 / www.sebrightproducts.com				AUBURN UNIVERSITY, AUBURN, AL 140311079 10646	
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