



City of Greenville

FIRE STATION NO. 2 EXPANSION AND ROOF REPLACEMENT

**500 S. Greene St.
Greenville, NC 27834**

PROJECT MANUAL

TEG PROJECT NO. 20160246

**ISSUE FOR CONSTRUCTION
October 26, 2017**



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CITY OF GREENVILLE
FIRE STATION NO. 2
EXPANSION AND ROOF REPLACEMENT



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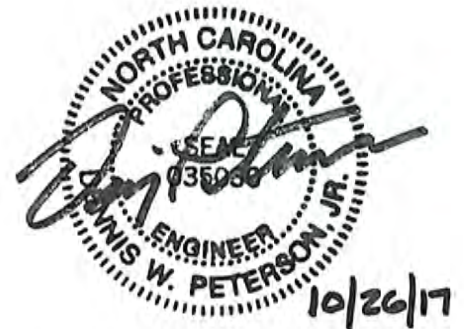
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SECTION 00100 - INVITATION TO BID

Sealed proposals will be received by The City of Greenville up until December 19th, 2017 at 2:00 PM, in the conference room of The City of Greenville Public Works Facility, 1500 Beatty Street, Greenville, NC 27834 for furnishing all labor, materials and equipment entering into the construction of **Fire Station No. 2 Expansion and Roof Replacement** in accordance with the documents prepared by The East Group, PA.

The basis of the contract will be a Single Prime General Contract.

A Pre-Bid Conference will be held December 5th, 2017 at 2:00 PM at the job site at 2490 Hemby Lane, Greenville, NC 27834.

A Site Visit will be mandatory. A site visit will be held after the Pre-Bid Conference with additional site visits by appointment.

A Bid Bond in the amount of 5% of the base bid will be required with each bid.

The Owner reserves the right to reject any or all bids and waive any and all defects and informalities in the submission of any bid.

END OF SECTION 00100

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Advertisement for Bids

Sealed bids will be received by The City of Greenville until December 19th, 2017 at 2:00 PM in the conference room of The City of Greenville Public Works Facility, 1500 Beatty Street, Greenville, NC. for furnishing all labor, materials and equipment entering into the construction of the

City of Greenville Fire Station No. 2 Expansion and Roof Replacement

GREENVILLE, NORTH CAROLINA

A Pre-Bid Conference will be held December 5th, 2017 at 2:00 PM at the job site at 2490 Hemby Lane, Greenville, NC 27834.

A Site Visit will be mandatory. A site visit will be held after the Pre-Bid Conference with additional site visits by appointment.

All times are Eastern Standard Time.

Lump sum proposals will be received for the following:

- Single Prime Bids will also be received for all Contract work

Complete Plans, Specifications and Contract Documents will be available free from the City of Greenville's Website, Full set of printed copies will also be available from DPI, Digital Printing and Imaging, in Greenville NC **at cost of printing**, contact

Digital Print & Imaging, Inc
115-a Red Banks Rd.
Greenville, NC 27858
252-321-3800
greenville@dpiinc.net

All questions regarding plans are to be referred to the architect of record, Richard Johnson, AIA of The East Group, via **email** at richard.johnson@eastgroup.com .

The Owner reserves the right to reject any and/or all bids and to waive any and all defects and informalities in the submission of any bid.

Abbreviated Written Summary: Briefly and without force and effect upon the contract documents, the work of the Prime Contracts can be summarized as follows:

The project involves an approximate 1,000 sf. expansion to the existing truck bays and reroofing the entire existing building.

All contractors must be properly licensed under the State Laws governing their respective trades.

All contractors are advised that the Owner has a minority and women participation policy for construction projects. Refer to the specifications for a detailed description of this policy.

The Owner reserves the right to reject any and/or all bids and to waive any and all defects and informalities in the submission of any bid.

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company insured by the Federal Deposit Insurance Corporation, of an amount equal to not less than 5

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percent of the proposal. In lieu thereof a bidder may offer a bid bond of 5 percent of the bid executed by a surety company licensed under the Laws of North Carolina to execute such bond conditioned that the surety will upon demand forthwith make payment to the obligee upon said bond if the bidder fails to execute the contract in accordance with the bid bond, and upon failure to forthwith make payment, the surety shall pay to the obligee an amount equal to double the amount of said bond. Said deposits shall be retained by the Owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten days after the award or to give satisfactory surety as required by law.

Performance and Payment Bond will be required for one hundred percent (100%) of the contract price.

Payment will be made on the basis of ninety percent (90%) of monthly estimates and final payment made upon completion and acceptance of work.

A contractor Reference Form, listing 3 client references of similar work is required.

No bid may be withdrawn after the scheduled closing time for the receipt of bids for a period of 60 days.

The Owner encourages the participation of MBE and WBE firms. Refer to the project manual for specific requirements.

Signed: Denisha Harris,
Purchasing Manager
City of Greenville

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POLICY STATEMENT

It is the policy of the City of Greenville to provide minorities and women equal opportunity for participating in all aspects of the City's contracting and procurement programs, including but not limited to, construction projects, supplies and materials purchase, and professional and personal service contracts.

OVERVIEW

The City of Greenville Minority and Women Business Enterprise Program (M/WBE) is a voluntary goals program in construction, purchasing, and professional and personal services based on "good-faith efforts". These goals are established for a three-year period and achievement will be evaluated annually.

The goals of the City for utilization of minority and women business enterprises are:

Minority business participation in construction services.	10%
Women business participation in construction services	6%
Minority business participation in supplies and materials purchases.	2%
Women business participation in supplies and materials purchases.	2%
Minority business participation in professional and personal services.	4%
Women business participation in professional and personal services.	4%

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I. INTRODUCTION

Efforts have been made by the City's staff to increase the amount of business the City awards to minority and women owned businesses. These efforts have produced minimal results.

In 1989, the North Carolina General Assembly amended G.S. 143-128 requiring the establishment of "verifiable percentage goals for minority business participation in contracts for the erection, construction, alteration or repair of public buildings" where the cost exceeded \$100,000.

Cities and other governmental bodies were to adopt a verifiable goal for participation by minority businesses after notice and public hearing. On December 12, 1989, the City of Greenville adopted an interim Minority Business Enterprise Participation Plan with a goal of ten (10) percent participation by minority individuals and businesses until a sufficient factual data base was collected to establish verifiable goals.

The City of Greenville conducted a Utilization Study of minority businesses in the City's purchasing programs based on an appropriate pool of qualified M/WBES. The City of Greenville contracted with the North Carolina Institute of Minority Economic Development to assist the City in establishing a verifiable Minority and Women Business Enterprise Goals Plan based on the statistical evidence of the study. The City of Greenville, in setting verifiable goals for the City's M/WBE Plan, considered statistical data derived from the Utilization Study and available potential M/WBES that could perform work in the disciplines germane to the City itself. The goals of the City do not require nor provide for racially based set-asides; rather they require a good faith effort by the City and its contractors to recruit and select minorities and women businesses, consistent with North Carolina General Statutes and the Constitution of the United States as interpreted by the **Croson Decision**.

II. ADMINISTRATION

The City Manager is authorized to take all usual and legal administrative actions necessary to implement this Plan. The ultimate responsibility for the MBE/WBE Plan's administration is assigned to the City Manager. The City Manager is either to be personally responsible or to designate a specific person to coordinate and manage this Plan. The City Manager or his designee is responsible for determining whether a contractor has complied with the provisions of this Plan or has shown good-faith effort to do so. Except for those staff services specifically assigned by this Plan to other departments, the heads of departments responsible for construction, procurement of services and materials shall be responsible to the City Manager or his designee and shall cooperate with the City Manager in implementing this Plan.

The M/WBE Plan shall apply to all contracts for construction, supplies, and

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Services as specified in Sections IV through VI. The provisions of this Plan take precedence over any other department plans or procedures in conflict herewith, except specific requirements mandated by terms or conditions of agreements in force between the City and the federal government or the State of North Carolina that require different procedures than those described in this Plan. This Plan will be evaluated at the end of three years to determine its effectiveness and what adjustments are required.

III. DEFINITIONS

Affirmative Action - Specific steps to eliminate discrimination and efforts to ensure nondiscriminatory results and practices in the future, and to fully involve minority business enterprises and women business enterprises in contracts and programs.

Bidder/Participant - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.

Contract - A mutually binding legal relationship or any modification thereof obligating the seller to furnish equipment or service, including construction and leases, and obligating the buyer to pay for them.

Contractor - Any person, firm, partnership, corporation, association, or joint venture that has been awarded a public contract or lease, including every subcontract on such a contract.

Discrimination - To distinguish, differentiate, separate and/or segregate on the basis of age, race, religion, color, sex, national origin, handicap and/or veteran status.

Equipment - Includes materials, supplies, commodities, and apparatus.

Goal - A voluntary percentage or quantitative objective.

Joint Venture - An association of two or more businesses to carry out a single business enterprise for profit, for which purpose they combine their property, capital, efforts, skills, and knowledge.

Lessee - A business that leases, or is negotiating to lease, property from the City or equipment or services to the City of Greenville, or to the public on City property.

Minority - A person who is a citizen or lawful permanent resident of the United States and who is:

- a. Black (a person having origins in any of the black racial groups of Africa);
- b. Hispanic (a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race);

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- c. Portuguese (a person of Portuguese, Brazilian, or other Portuguese culture origin, regardless of race);
- d. Asian (a person having origins in any of the original people of the Far East, Southeast Asia, the Indian sub-continent, or the Pacific Islands); and
- e. American Indian and Alaskan Native (a person having origins in any of the original people of North America).

MBE/WBE - Any minority or women business enterprise.

Minority or Women Business Enterprise (MBE/WBE) - A business that is at least fifty-one (51) percent owned and controlled by minority group members or women. An MBE/WBE is **bona fide** only if the minority group or female ownership interests are real and continuing and not created solely to meet the MBE/WBE requirement. In addition, the MBE/WBE must itself perform satisfactory work or services or provide supplies under the contract and not act as a mere conduit. In short, the contractual relationship must also be **bona fide**.

IV. PROCEDURES FOR CONSTRUCTION CONTRACTS

A. Purpose and Application

1. The general purpose of this Plan is to help develop and support Minority and Women Business Enterprises (MBE and WBE) by providing opportunities for participation in the performance of all construction contracts financed entirely with City funds.
2. This Plan shall apply to construction contracts when the City's estimated contract cost is \$50,000 or more, except when a contract is exempt from competitive bidding under the General Statutes of North Carolina. Contracts between \$5,000 and \$50,000 that are negotiated will also be covered.
3. Where contracts are financed in whole or in part with federal or state funds, including grants, loans, or other funding sources containing MBE and WBE Programs, the City will, where permitted by the grantor, meet the Plan requirements with the highest MBE/WBE goals. The City Manager will be responsible for monitoring the Plan to ensure the goals are met.
4. Since City construction contracts are prepared and administered by the Engineering Department and various other departments, each of these departments shall prepare such departmental procedures for bidding and outreach as are required to implement this Plan.
 - a. Within ninety (90) days of City approval of this Program, appropriate staff and equipment will be in place for full implementation.

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- b. The departmental procedures and contract provisions shall be in effect for all bid documents Issued after the date of the City's approval.

B. MBE/WBE Goals

1. To implement the purpose of this Plan, the goal shall be to award at least ten (10) percent of the total of all construction contract award amounts in each fiscal year in each department to MBE firms and at least four (6) percent to WBE firms.
2. The City Manager and/or M/WBE Plan Coordinator may determine that higher or lower goals are appropriate on a project by-project basis, where it can be shown that the type, size, or location of the project will affect the availability of MBE and WBE firms, so long as the aggregate of all contracts does not lower the annual goals.

C. Bid Documents

1. Bidders shall submit MBE/WBE information with their bids. Such information shall be subject to verification by the City prior to the awarding of the contract. The information shall include names of MBE/WBES to be used and the dollar value of each such MBE/WBE transaction.
2. Contractors, subcontractors, suppliers, or MBE/WBE members of a joint venture intended to satisfy the City's MBE/WBE goals shall be certified by the State Department of Transportation (DOT) or shall be listed on another Public Agency certified list. The City may accept any of the following as alternate sources of certified MBES and WBES:
 - a. Listing in a City or certified registry established in accordance with Section IV, 0(2) of this Plan.
 - b. A self-certification form for a MBE/WBE or a MBE/WBE member of a joint venture not already listed in the Registry or certified by the State.
 - c. Evidence of certification or the self-certification form submitted to the City at or before the bid opening.

D. City of Greenville Responsibilities

1. **MBE/WBE Registry** - The City will establish and maintain a registry of certified Minority and Women Business Enterprises. The purpose of the registry is to provide a resource for prime bidders on City's construction projects who intend to solicit bids from MBE and WBE subcontractors and suppliers to

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meet the City's MBE and WBE goals. The registry will not constitute a recommendation or endorsement of any listed firm. The registry will be developed and maintained by advertising at least annually, for letters of interest from MBE and WBE firms and community organizations wishing to be included in the registry and notified of construction contracts and sole source contracts (one source). Advertisements will be placed in at least one newspaper of general circulation and in at least one minority newspaper in the state.

2. Certification

- (a) The certification process will involve submission of a completed City certification form or inclusion on another acceptable public agency registry. All businesses must be recertified every twenty-four (24) months. The submitted form will be subject to approval by the City Manager or his designee. The City may accept proof of certification from the following:
- North Carolina Department of Transportation
 - North Carolina Department of Administration
 - Other North Carolina cities with established certification procedures.
- (b) Certification decisions made by the City can be appealed by the applicant or a third-party challenger. Protests must be delivered to the MIWBE Office in writing or forwarded to the City Manager's Office. MBE/WBE applicants for certification with the City are allowed ten (10) days after the receipt of the certification decision to protest. A third-party challenge can be submitted at any time. Written protests will be reviewed by the City Manager, who will render a final decision.

3. Certification Eligibility Standards

- (a) The eligibility of a business is determined by the ownership and control of the business.
- (b) An eligible Minority Business Enterprise owner is a citizen or lawful permanent resident of the United States, a member of a recognized ethnic or racial group, and fifty one (51) percent owner of the business.

The eligible ethnic or racial groups are:

- Black

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- . Hispanic
- . Portuguese
- . Asian/Pacific Islander
- . American Indian/Alaskan Native

(c) An eligible Women Business Enterprise owner is a citizen or lawful resident of the United States and a fifty-one (51) percent owner of the business and is female.

4. **Decertification Procedures** - A firm certified as a MBE/WBE may be decertified by the City Manager or his designee after an investigation and hearing for anyone of the following reasons:
- a. Change of Status - The City Manager or his designee may decertify a MBE/WBE if he finds that the ownership or control of the business changes so that the business no longer meets the requirements of Section IV, 0(3) (b) and (c) above.
 - b. Failure to comply with the MBE/WBE Plan - The certification of a business as a MBE/WBE may be revoked by the City Manager or his designee if he finds any of the following conditions:
 - 1. That a business has submitted inaccurate, false or incomplete information to the City;
 - 2. That in performance of a contract, a business has failed to comply with requirements of the contract with the City;
 - 3. That in performance of a contract, a business has failed to comply with MBE/WBE requirements of a contract established by a contractor with the City in response to City requirements; or
 - 4. That a business has otherwise failed to comply with the provisions of this MBE/WBE Plan.
 - c. Appeal of Decertification - A business may appeal a determination to decertify as a MBE/WBE by utilizing the procedures described in Section IV, D(2) above.
5. **Pre-bid Conference** - The City may hold a pre-bid conference on all formal bid contracts for all prospective bidders, subcontractors, and MBE/WBES for the purpose of explaining the provisions of the MBE/WBE Plan, the process for bidding, and the contract to be performed. Available data on MBE/WBES interested and/or capable of engaging in the prospective contract

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shall be made available to prospective bidders, contractors, and subcontractors.

E. Contractor Responsibilities

1. The contractor (bidder) shall make good-faith efforts to encourage participation of MBE/WBES in projects prior to submission of bids in order to be considered as a responsive bidder. A good-faith effort shall include, at a minimum, specific affirmative action steps and complete documentation thereof. The following list of factors to determine good-faith effort is not exclusive or exhaustive:
 - a. Whether the bidder attended any pre-solicitation or pre-bid meetings, if scheduled by the City;
 - b. Whether the bidder identified and selected specific items of the project for which the contract could be performed by Minority and/or Women Business Enterprises, to provide an opportunity for participation by those enterprises (including, where appropriate, breaking down contracts into economically feasible units to facilitate MBE/WBE participation);
 - c. Whether the bidder advertised, a reasonable time before the date the bids are opened, in one or more daily or minority weekly newspaper or trade association (i.e., N.C. Minority Business Association), trade journal or other media;
 - d. Whether the bidder provided mail notice of his or her interest in bidding on the contract to at least three (3) Minority or Women Business Enterprises (for each identified sub-item of the contract) licensed to provide the specific items of the project a reasonable time prior to the opening of bids;
 - e. Whether the bidder provided interested Minority and Women Business Enterprises with information about the plans, specifications, and requirements for the selected subcontracting or material supply work;
 - f. Whether the bidder contacted the City's MIWBE Office for assistance in identifying minority and women businesses certified with the City and three (3) approved public agencies as referenced in Section IV, D(2)a;
 - g. Whether the bidder negotiated in good-faith with Minority or Women Business Enterprises and did not unjustifiably reject as unsatisfactory bids prepared by Minority or

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Women Business Enterprises, as defined by the City;

- h. Whether the bidder, where applicable, advised and made efforts to assist interested Minority and Women Business Enterprises in obtaining bonds, lines of credit, or insurance required by the City or contractor;
- i. Whether the bidder's efforts to obtain Minority and Women Business Enterprise participation could reasonably be expected by the City to produce a level of participation sufficient to meet the goals of the City.

Bidders are cautioned that even though their submittal indicates they will meet the MBE/WBE goals, they should document their good-faith efforts and be prepared to submit this information to protect their eligibility for award of the contract in the event the City questions whether the good-faith requirement has been met.

- 2. Performance of MBE and WBE Subcontractors and Suppliers The MBE/WBES listed by the contractor on the Schedule of MBE/WBE Participation, which are determined by the City to be certified, shall perform the work and supply the materials for which they are listed unless the contractor has received prior written authorization from the City to perform the work with other forces or to obtain the materials from other sources.

The contractor shall enter into and supply copies of fully executed subcontracts with each MBE/WBE listed on the "Bidder MBE/WBE Information" form to the City's MIWBE Plan Coordinator after award of the contract and prior to the issuance of a Notice to Proceed. Any amendments to the subcontracts shall be submitted to the MIWBE Office within five (5) days of execution.

Authorization to utilize other forces or sources of materials may be requested for the following reasons:

- a. The listed MBE/WBE, after having had a reasonable opportunity to do so, fails or refuses to execute a written contract, when such written contract, based upon the general terms, conditions, plans and specifications for the project, or on the terms of such subcontractor's or supplier's written bid, is presented by the contractor.
- b. The listed MBE/WBE becomes bankrupt or insolvent.
- c. The listed MBE/WBE fails or refuses to perform his/her subcontract or furnish the listed materials.

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- d. The work performed by the listed subcontractor is unsatisfactory according to industry standards and is not in accordance with the plans and specifications; or the subcontractor is substantially delaying or disrupting the progress of the work.

F. Awarding of Contracts

1. If a construction contract is to be awarded, it shall be awarded in accordance with North Carolina General Statutes to the lowest responsible bidder who complies with all of the prescribed requirements and either:
 - a. Made a good-faith effort to comply with these goals and requirements before the time bids are opened as described above. Where a good-faith effort is claimed by the apparent lowest responsible bidder, the bidder shall be required to submit documentation WITHIN TWENTY-FOUR (24) HOURS OF THE CITY'S NOTIFICATION, which in most instances will occur the day of bid opening to show that the criteria for good-faith efforts have been met, or
 - b. Once a firm is determined to be an eligible MBE/WBE, and before the contract is awarded, the total dollar value to be paid to the MBE/WBE shall be evaluated by the MIWBE Office to ensure that it is in accordance with the bidder's proposal.

If the evaluation shows that the bidder has misrepresented MBE/WBE participation or has not made a good-faith effort to meet the contract goals for MBE and WBE participation, the bidder may be disqualified.

G. Counting MBE/WBE Participation Toward Meeting the Goals –

The degree of participation by MBE/WBE contractors, subcontractors, suppliers, or joint-venture partners in contract awards shall be counted in the following manner:

1. Once a firm is determined to be an eligible MBE/WBE contractor in accordance with this Plan, the total dollar value of the contract awarded to the MBE/WBE is counted as participation.
2. The goals can be met by any certified MBE/WBE contractor, subcontractor, supplier, trucker, or joint venture partner as listed in the City and agency directory. All MBE/WBES used to meet the goal must be certified by the City or an approved agency at the time of bid opening. Only certified firms listed in the directory can be

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counted toward the goal. The standard for certification is set forth in this Plan.

3. The total dollar value of a contract with a business owned and controlled by a minority woman is counted toward either the minority goal or the goal for women, but not toward both. The contractor or City employing the firm may choose the goal to which the value is applied.
4. In the case of a joint venture, the joint venture recipient or contractor may count toward its MBE/WBE goals a portion of the total dollar value of the contract that the MBE/WBE partner's participation in the joint venture represents. Credit will be given equal to the minority partner's percentage of ownership in the joint venture. A MBE/WBE joint-venture partner must be responsible for a clearly defined portion of the work to be performed in addition to satisfying requirements for ownership and control.
5. A recipient or contractor may count toward its MBE/WBE goals only expenditures to MBE/WBE whose ownership interests are real and continuing and not created solely to meet the City's goals for participation, and that perform a commercially useful function in the work of a contract. A MBE/WBE is considered to perform a commercially useful function when it is responsible for execution of a distinct element of the work of a contract and carries out its responsibilities by actually performing, managing, and supervising the work involved. To determine whether a MBE/WBE is performing a commercially useful function, the M/WBE Office shall evaluate the amount of work subcontracted, industry practices, and other relevant factors. Consistent with normal industry practices, an MBE/WBE may enter into subcontracts. If a MBE/WBE contractor subcontracts a significantly greater portion of the work of the contract than would be expected on the basis of normal industry practices, the MBE/WBE shall be presumed not to be performing a commercially useful function. Evidence to rebut this presumption may be presented to the City. The MBE/WBE may present evidence to rebut this presumption. The M/WBE Office's decision on the rebuttal of this presumption is subject to review by the City Manager or his designated representative. Once a firm is determined to be an eligible MBE/WBE in accordance with this section, the total dollar value of the contract awarded to MBE/WBE is counted toward the applicable MBE/WBE goals, except as provided in the provisions of this section.

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6. A contractor may count toward its MBE/WBE goals expenditures for materials and supplies obtained from MBE/WBE suppliers and manufacturers, provided that the MBE/WBE assumes the actual and contractual responsibility for the provision of the materials and supplies.

H. Documentation of Attainment of MBE/WBE Participation Requirements - In order that the City Manager may make a recommendation to the City as to the responsiveness of bidders, bidders shall be required to submit the following information on each MIWBE-related subcontract:

1. A description of the subcontract and purchase(s) of significant equipment and supplies to be used to perform the subcontract or prime contract, including the name and address of each MBE/WBE firm selected, and the name and telephone number of a contact person;
2. The dollar amount of participation of each MBE/WBE;
3. A statement of intent from the MBE/WBE subcontractor or material supplier as
 - a. Identified in Section IV, H(1) above that they intend to contract or supply the materials, or
 - b. Sworn statements, with appropriate documentation, showing that the contractor made a good-faith effort to comply with the MBE/WBE Plan in accordance with Section IV, E of this Plan.

VII. GRIEVANCE PROCEDURE

Any participant feeling himself/herself aggrieved by implementation of the MBE/WBE Program may present such grievance to the City. The grievance (except for certification as a MBE/WBE) shall be first discussed with the responsible operating department. If the grievance is not resolved, a written description of the grievance with appropriate supporting evidence shall be presented to the M/WBE Program Coordinator. The M/WBE Program Coordinator will review the grievance and supporting evidence and make a written response to the participant within ten (10) working days. In the event the participant is not satisfied, said participant may appeal the grievance by filing a written description thereof and supporting evidence with the City Manager. The City Manager shall hear the grievance within ten (10) working days and shall make a decision thereon, which shall be final.

**CITY OF GREENVILLE
FIRE STATION NO. 2
EXPANSION AND ROOF REPLACEMENT**

SECTION 00215 - DOCUMENT CLARIFICATION REQUEST (DCR)

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Work Specified This Section:
 - 1. This Section specifies administrative and procedural requirements for disposition of Document Clarification Request (DCRs) during the Bidding Phase.

1.2 SUBMITTALS

- A. Submit each request (DCR) on the form included this in section.
- B. Provide only one request on each form.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 CONDITIONS:

- A. Submit requests to the Architect as soon as possible.
- B. DCRs will be received up to seven (7) calendar days prior to the Bid date. DCRs received after that date will not be reviewed.

3.2 ARCHITECT'S ACTION:

- A. The Architect will review the information requested.
 - 1. If, after researching the issue, if the information is found within the Contract Documents, then no formal response will be forth coming.
- B. The Architect's response will be in the space provided on the DCR form included this in section.

**CITY OF GREENVILLE
FIRE STATION NO. 2
EXPANSION AND ROOF REPLACEMENT**

00215 – DOCUMENT CLARIFICATION REQUEST (DCR)

DOCUMENT CLARIFICATION REQUEST		Date:
Attention: Richard Johnson	Submitted By:	
The East Group, PA 324 Evans Street Greenville NC 27835		
Subject:		
Specification Number:		
Drawing Sheet Number:		
INFORMATION REQUESTED		
Signed: _____		
RESPONSE		
<input type="checkbox"/> See Drawings/Specifications _____		
<input type="checkbox"/> See Addenda to be issued		
<input type="checkbox"/> Other		

Answered By: _____

Date: _____

END OF DOCUMENT 00215

**CITY OF GREENVILLE
FIRE STATION NO. 2
EXPANSION AND ROOF REPLACEMENT**

SECTION 00231 - PRODUCT SUBSTITUTIONS DURING BID

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work Specified This Section:

1. This Section specifies administrative and procedural requirements for submitting requests for substitutions prior to Bid.

1.2 SUBMITTALS

A. Substitution Request Submittal:

1. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
2. Provide complete documentation showing compliance with the requirements for substitutions, and the following information:
 - a) Original copies of Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
 - b) Samples.
 - c) A detailed point by point comparison of the proposed substitution and the specified product detailing the significant qualities of both products. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
 - d) Ensure the product fits in the designated space.
 - e) The manufacturer or fabricator shall certify or guarantee the specified product as required by the Documents.
 - f) The substitution is in compliance with applicable code requirements.
 - g) Coordination information:
 - 1) Including a list of changes or modifications required to other parts of the Work and to construction performed by the Owner and separate Contractors, which will become necessary to accommodate the proposed substitution.
 - h) Certification by the Bidder that the substitution proposed is equal-to or better in every significant respect to that required by the Documents, and that it will perform adequately in the application indicated.

B. Architect's Action:

1. After receipt of the request for substitution, the Architect may request additional information or documentation for evaluation.
2. If a proposed substitute is accepted, it will be indicated in an upcoming Addendum.
3. Architect's decision is final and such reasons, if not approved, will not be furnished.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION 00231

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**CITY OF GREENVILLE
FIRE STATION NO. 2
EXPANSION AND ROOF REPLACEMENT**

BID FORM

TO: **City of Greenville**
herein called "OWNER"

1. Pursuant to and in compliance with the invitation to bid and the proposed Contract Documents relating to construction of:

**City of Greenville
Fire Station No. 2
Expansion and Roof Replacement**

the undersigned, having become thoroughly familiar with the terms and conditions of the proposed Contract Documents and with local conditions affecting the performance and costs of the Work at the place where the Work is to be completed, and having fully inspected the site in all particulars, hereby proposes and agrees to fully perform the Work within the time allowed and in strict accordance with proposed Contract Documents, including furnishing any and all labor and materials, and to do all of the work required to construct and complete said Work in accordance with the Contract Documents, for the following sum of money:

Single Prime Bid:

BIDDER'S COMPANY NAME: _____

BASE BID _____ (\$ _____)

ADD ALTERNATE NO. 1

Replace existing truck bay lights with LED lights activated by motion sensors (\$ _____)

ADD ALTERNATE NO. 2

Provide and install new overhead door motors and hardware as listed on Drawing A2.1. (\$ _____)

LIST OF SUBCONTRACTORS			
	NAME OF COMPANY/ADDRESS		BID

ATTACH CHECK, CASH OR BID BOND TO THIS PROPOSAL.

**CITY OF GREENVILLE
FIRE STATION NO. 2
EXPANSION AND ROOF REPLACEMENT**

2. I understand that the Owner reserves the right to reject this bid, but that this bid shall remain open and not be withdrawn for a period of 60 days from the date prescribed for its opening.
3. If written notice of the acceptance of this bid is mailed or delivered to the undersigned within 45 days after the date set for the opening of this bid, or at any other time thereafter before it is withdrawn, the undersigned will execute and deliver the Contract Documents to Owner in accordance with this bid accepted, and will also furnish and deliver proof of insurance coverage, all within ten days after deposit in the mails of the notification of acceptance of this bid.
4. Notice of acceptance, or request for additional information, may be addressed to the undersigned at the address set forth below.
5. The bidder acknowledges receipt of the following Addenda and has incorporated bid revisions in this bid proposal.

Addendum No.	Dated	Received	Addendum No.	Dated	Received
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

6. Construction Time: The undersigned agrees if he is the successful bidder to commence work under this contract on a date to be specified by the Owner and to fully complete all work on the Project within the following period set forth below.

120 Consecutive Calendar Days

7. The bidder further agrees that the Owner has the right to withhold from compensation otherwise to be paid the amount of three hundred dollars (**\$300.00**) per day that the work is not completed after the completion date defined above as liquidated damages reasonably determined to be incurred by the Owner as a result of such delay.
8. The names of all persons interested in the foregoing bid as principals are:

IMPORTANT NOTICE: If bidder or other interested persons is a corporation, give legal name of corporation, state in where incorporated, and names of president and secretary; if a partnership, give names of firm and names of all individual co-partners composing the firm; if bidder or other interested person is an individual, give first and last names in full.)

Licensed in accordance with an act for the registration of contractors, and with N.C. license number _____.

Sales and use tax registration number _____.

**CITY OF GREENVILLE
FIRE STATION NO. 2
EXPANSION AND ROOF REPLACEMENT**

SIGN HERE:

Signature of Bidder

NOTE: If bidder is a corporation, set forth the legal name of the corporation together with the signature of the officer or officers authorized to sign contracts on behalf of the corporation. If bidder is a partnership, set forth the name of the firm together with the signature of the partner or partners authorized to sign contracts on behalf of the partnership.

Business address: _____

(Corporate Seal)

Telephone number: _____ Date of proposal: _____

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**CITY OF GREENVILLE
FIRE STATION NO. 2
EXPANSION AND ROOF REPLACEMENT**

REFERENCE INFORMATION

All bidders must provide a list of three (3) client references of similar work. The reference information must include the company's name, a contact person's name with his or her title and their telephone number. Contractor must provide the information below with their bid sheet.

1. COMPANY NAME: _____

CONTACT PERSON: _____

PHONE NUMBER: _____ MOBILE PHONE NO. _____

EMAIL: _____ BUSINESS FAX NO. _____

2. COMPANY NAME: _____

CONTACT PERSON: _____

PHONE NUMBER: _____ MOBILE PHONE NO. _____

EMAIL: _____ BUSINESS FAX NO. _____

3. COMPANY NAME: _____

CONTACT PERSON: _____

PHONE NUMBER: _____ MOBILE PHONE NO. _____

EMAIL: _____ BUSINESS FAX NO. _____

**CITY OF GREENVILLE
FIRE STATION NO. 2
EXPANSION AND ROOF REPLACEMENT**

CONTRACTOR INFORMATION

Contractor must provide the information below with the bid sheet.

PROSPECTIVE CONTRACTOR DATA FORM

COMPANY NAME: _____

ADDRESS: _____

PHONE NUMBER: _____ MOBILE PHONE NO. _____

EMAIL: _____ BUSINESS FAX NO. _____

TAX ID#: _____

Corporation Or Partnership: _____

Number of Years in Business: _____

Number of Years in Greenville Area: _____

Number of Permanent Employees: _____

Number of Part-time Employees: _____

**City of Greenville/Greenville Utilities Commission
Minority and Women Business Enterprise (MWBE) Program**

**City of Greenville
Construction Guidelines and Affidavits
\$100,000 and above**

These instructions shall be included with each bid solicitation.

City of Greenville/Greenville Utilities Commission Minority and Women Business Enterprise Program

\$100,000 and Construction Guidelines for MWBE Participants

Policy Statement

It is the policy of the City of Greenville and Greenville Utilities Commission to provide minorities and women equal opportunity for participating in all aspects of the City’s and Utilities’ contracting and procurement programs, including but not limited to, construction projects, supplies and materials purchases, and professional and personal service contracts.

Goals and Good Faith Efforts

Bidders responding to this solicitation shall comply with the MWBE program by making Good Faith Efforts to achieve the following aspiration goals for participation.

	CITY	
	MBE	WBE
Construction This goal includes Construction Manager at Risk.	10%	6%

Bidders shall submit MWBE information with their bids on the forms provided. This information will be subject to verification by the City prior to contract award. **As of July 1, 2009, contractors, subcontractors, suppliers, service providers, or MWBE members of joint ventures intended to satisfy City MWBE goals shall be certified by the NC Office of Historically Underutilized Businesses (NC HUB) only.** Firms qualifying as “WBE” for City’s goals must be designated as a “women-owned business” by the HUB Office. Firms qualifying as “MBE” for the City’s goals must be certified in one of the other categories (i.e.: Black, Hispanic, Asian American, American Indian, Disabled, or Socially and Economically Disadvantaged). Those firms who are certified as both a “WBE” and “MBE” may only satisfy the “MBE” requirement. **Each goal must be met separately. Exceeding one goal does not satisfy requirements for the other.** A complete database of NC HUB certified firms may be found at <http://www.doa.nc.gov/hub/>. An internal database of firms who have expressed interest to do business with the City and GUC is available at www.greenvillenc.gov. However, the HUB status of these firms must be verified by the HUB database. The City shall accept NCDOT certified firms on federally funded projects only. Please note: A contractor may utilize any firm desired. However, for participation purposes, all MWBE vendors who wish to do business as a minority or female must be certified by NC HUB.

The Bidder shall make good faith efforts to encourage participation of MWBEs prior to submission of bids in order to be considered as a responsive bidder. Bidders are cautioned that even though their submittal indicates they will meet the MWBE goal, they should document their good faith efforts and be prepared to submit this information, if requested.

The MWBE’s listed by the Contractor on the **Identification of Minority/Women Business Participation** which are determined by the City to be certified shall perform the work and supply the materials for which they are listed unless the Contractors receive prior authorization from the City to perform the work with other forces or to obtain materials from other sources. If a contractor is proposing to perform all elements of the work with his own forces, he must be prepared to document evidence satisfactory to the owner of similar government contracts where he has self-performed.

Attach to Bid Attach to Bid Attach to Bid Attach to Bid Attach to Bid Attach to Bid Attach to Bid Attach to Bid
The Contractor shall enter into and supply copies of fully executed subcontracts with each MWBE or supply signed Letter(s) of Intent to the Project Manager after award of contract and prior to Notice to Proceed. Any amendments to subcontracts shall be submitted to the Project Manager prior to execution.

Instructions

The Bidder shall provide with the bid the following documentation:

- Identification of Minority/Women Business Participation
(if participation is zero, please mark zero—Blank forms will be considered nonresponsive)
- Affidavit A (if subcontracting)

OR

- Identification of Minority/Women Business Participation
(if participation is zero, please mark zero—Blank forms will be considered nonresponsive)
- Affidavit B (if self-performing; must attest that bidder does not customarily subcontract work on this type of project—includes supplies and materials)

Within 72 hours or 3 business days after notification of being the apparent low bidder who is subcontracting anything must provide the following information:

- Affidavit C (if aspirational goals are met or are exceeded)

OR

- Affidavit D (if aspirational goals are not met)

After award of contract and prior to issuance of notice to proceed:

- Letter(s) of Intent or Executed Contracts

****With each pay request, the prime contractors will submit the Proof of Payment Certification, listing payments made to MWBE subcontractors.**

*****If a change is needed in MWBE Participation, submit a Request to Change MWBE Participation Form. Good Faith Efforts to substitute with another MWBE contractor must be demonstrated.**

Minimum Compliance Requirements:

All written statements, affidavits, or intentions made by the Bidder shall become a part of the agreement between the Contractor and the City for performance of contracts. Failure to comply with any of these statements, affidavits or intentions or with the minority business guidelines shall constitute a breach of the contract. A finding by the City that any information submitted (either prior to award of the contract or during the performance of the contract) is inaccurate, false, or incomplete, shall also constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the City whether to terminate the contract for breach or not. In determining whether a contractor has made Good Faith Efforts, the CITY will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts.

MBForms 2002-
Revised July 2010
Updated 2015

City of Greenville AFFIDAVIT A – Listing of Good Faith Efforts

County of _____

(Name of Bidder)

Affidavit of _____

I have made a good faith effort to comply under the following areas checked:

Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive. (1 NC Administrative Code 30 I.0101)

- 1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- 2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- 3 – (15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- 4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- 5 – (10 pts)** Attended prebid meetings scheduled by the public owner.
- 6 – (20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- 7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- 8 – (25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- 9 – (20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- 10 - (20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority/Women Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority/women business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____



State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

City of Greenville --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce.

County of _____

Affidavit of _____

(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the _____

_____ contract.

(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

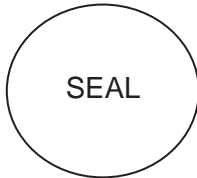
The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____



State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20__

Notary Public _____

My commission expires _____

City of Greenville - **AFFIDAVIT C** - Portion of the Work to be Performed by MWBE Firms

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the portion of the work to be executed by MWBE businesses as defined in GS143-128.2(g) and the COG/CITY MWBE Plan sec. III is equal to or greater than 16% of the bidders total contract price, then the bidder must complete this affidavit. This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

Affidavit of _____ I do hereby certify that on the _____
 (Name of Bidder)

Project ID# _____ (Project Name) Amount of Bid \$ _____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises and a minimum of _____% of the total dollar amount of the contract with women business enterprises. Minority/women businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. Attach additional sheets if required

Name and Phone Number	*MWBE Category	Work description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic or Latino (**L**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**S**) Disabled (**D**)

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with MWBE Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____



State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

City of Greenville **AFFIDAVIT D – Good Faith Efforts**

County of _____

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the goal of 16% participation by minority/women business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

Affidavit of _____ I do hereby certify
that on the _____
(Name of Bidder)

Project ID# _____ (Project Name) _____
Amount of Bid \$ _____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises and a minimum of _____% of the total dollar amount of the contract with women business enterprises. Minority/women businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

Name and Phone Number	*MWBE Category	Work description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic or Latino (**L**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**S**) Disabled (**D**)

Examples of documentation required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

- A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.
- B. Copies of quotes or responses received from each firm responding to the solicitation.
- C. A telephone log of follow-up calls to each firm sent a solicitation.
- D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.
 - E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.
- F. Copy of pre-bid roster.
- G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.
- H. Letter detailing reasons for rejection of minority business due to lack of qualification.
- I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the

Do not submit with the bid Do not submit with the bid Do not submit with the bid Do not submit with the bid

next lowest responsible and responsive bidder.

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with MWBE Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____



State of _____, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public _____

My commission expires _____

LETTER OF INTENT MWBE Subcontractor Performance

Please submit this form or executed subcontracts with MWBE firms after award of contract and prior to issuance of notice to proceed.

PROJECT: _____
(Project Name)

TO: _____
(Name of Prime Bidder/Architect)

The undersigned intends to perform work in connection with the above project as a:

____ Minority Business Enterprise _____ Women Business Enterprise

The MWBE status of the undersigned is certified the NC Office of Historically Underutilized Businesses (required). ___ Yes ___ No

The undersigned is prepared to perform the following described work or provide materials or services in connection with the above project at the following dollar amount:

Work/Materials/Service Provided	Dollar Amount of Contract	Projected Start Date	Projected End Date

(Date)

(Address)

(Name & Phone No. of MWBE Firm)

(Name & Title of Authorized Representative of MWBE)

(Signature of Authorized Representative of MWBE)

REQUEST TO CHANGE MWBE PARTICIPATION

(Submit changes only if notified as apparent lowest bidder, continuing through project completion)

Project: _____

Bidder or Prime Contractor: _____

Name & Title of Authorized Representative: _____

Address: _____ **Phone #:** _____

_____ **Email Address:** _____

Total Contract Amount (including approved change orders or amendments): \$ _____

Name of subcontractor: _____

Good or service provided: _____

Proposed Action:

Replace subcontractor

Perform work with own forces

For the above actions, you must provide one of the following reasons (Please check applicable reason):

The listed MBE/WBE, after having had a reasonable opportunity to do so, fails or refuses to execute a written contract.

The listed MBE/WBE is bankrupt or insolvent.

The listed MBE/WBE fails or refuses to perform his/her subcontract or furnish the listed materials.

The work performed by the listed subcontractor is unsatisfactory according to industry standards and is not in accordance with the plans and specifications; or the subcontractor is substantially delaying or disrupting the progress of the work.

Do not submit with the bid Do not submit with the bid Do not submit with the bid Do not submit with the bid

Pay Application No. _____
Purchase Order No. _____

Proof of Payment Certification MWBE Contractors, Suppliers, Service Providers

Project Name: _____

Prime Contractor: _____

Current Contract Amount (including change orders): \$ _____

Requested Payment Amount for this Period: \$ _____

Is this the final payment? ___Yes ___No

Firm Name	MWBE Category*	Total Amount Paid from this Pay Request	Total Contract Amount (including changes)	Total Amount Remaining

*Minority categories: Black, African American (B), Hispanic or Latino (L), Asian American (A) American Indian (I), Female (F) Socially and Economically Disadvantaged (S) Disabled (D)

Date: _____

Certified By: _____

Name

Title

Signature

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**CITY OF GREENVILLE
FIRE STATION NO. 2
EXPANSION AND ROOF REPLACEMENT**

STATE OF NORTH CAROLINA

AFFIDAVIT

CITY OF GREENVILLE

I, _____ (the individual attesting below), being duly authorized by and on behalf of _____ (the entity bidding on project hereinafter "Employer") after first being duly sworn hereby swears or affirms as follows:

1. Employer understands that E-Verify is the federal E-Verify program operated by the United States Department of Homeland Security and other federal agencies, or any successor or equivalent program used to verify the work authorization of newly hired employees pursuant to federal law in accordance with NCGS §64-25(5).
 2. Employer understands that Employers Must Use E-Verify. Each employer, after hiring an employee to work in the United States, shall verify the work authorization of the employee through E-Verify in accordance with NCGS§64-26(a).
 3. Employer is a person, business entity, or other organization that transacts business in this State and that employs 25 or more employees in this State. (mark Yes or No)
 - a. YES _____, or
 - b. NO _____
 4. Employer's subcontractors comply with E-Verify, and if Employer is the winning bidder on this project Employer will ensure compliance with E-Verify by any subcontractors subsequently hired by Employer.
- This ____ day of _____, 2013.

Signature of Affiant
Print or Type Name: _____

State of North Carolina City of Greenville

Signed and sworn to (or affirmed) before me, this the ____ day of _____, 2017.

My Commission Expires:

Notary Public

||
||
(Affix Official/Notarial Seal)

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**IRAN DIVESTMENT ACT CERTIFICATION REQUIRED BY N.C.G.S.
143C-6A-5(a)**

Name of Contractor, Vendor or Bidder: _____

As of the date listed below, the contractor, vendor or bidder listed above, and all subcontractors utilized by the contractor, vendor or bidder listed above, is not listed on the Final Divestment List created by the State Treasurer pursuant to N.C.G.S. 143-6A-4.

The undersigned hereby certifies that he or she is authorized by the contractor, vendor or bidder listed above to make the foregoing statement.

Signature

Date

Printed Name

Title

Notes to persons signing this form:

N.C.G.S. 143C-6A-5(a) requires this certification for bids or contracts with the State of North Carolina, a North Carolina local government, or any other political subdivision of the State of North Carolina. The certification is required at the following times:

- When a bid is submitted
- When a contract is entered into (if the certification was not already made when the vendor made its bid)
- When a contract is renewed or assigned

N.C.G.S. 143C-6A-5(b) requires that contractors with the State, a North Carolina local government, or any other political subdivision of the State of North Carolina must not utilize any subcontractor found on the State Treasurer's Final Divestment List. The State Treasurer's Final Divestment List can be found on the State Treasurer's website at the address www.nctreasurer.com/Iran and will be updated every 180 days.

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**CITY OF GREENVILLE
FIRE STATION NO. 2
EXPANSION AND ROOF REPLACEMENT**

**A.I.A. DOCUMENT A310
BID BOND**

The above document is hereby made a part of these contract documents. Copies of this standard document are available from:

1. The American Institute of Architects
1735 New York Ave., N.W.
Washington, D.C. 20006
2. AIA North Carolina
14 East Peace St.
Raleigh, NC 27604
3. The East Group Architecture, P.A.
324 Evans St.
Greenville, NC 27858

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FIRE STATION NO. 2
EXPANSION AND ROOF REPLACEMENT**

**DOCUMENT A312
PERFORMANCE BOND
LABOR AND MATERIAL PAYMENT BOND**

The above document is hereby made a part of these contract documents. Copies of this standard document are available from:

1. The American Institute of Architects
1735 New York Ave., N.W.
Washington, D.C. 20006
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**CITY OF GREENVILLE
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EXPANSION AND ROOF REPLACEMENT**

**A.I.A. DOCUMENT A701
INSTRUCTIONS TO BIDDERS
1997 EDITION**

The above document is hereby made a part of these contract documents. Copies of this standard document are available from:

1. The American Institute of Architects
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Washington, D.C. 20006
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**A.I.A. DOCUMENT A101
STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR
1997 EDITION**

The above document is hereby made a part of these contract documents. Copies of this standard document are available from:

1. The American Institute of Architects
1735 New York Ave., N.W.
Washington, D.C. 20006
2. AIA North Carolina
14 East Peace St.
Raleigh, NC 27604
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**A.I.A. DOCUMENT A201
GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION
1997 EDITION**

The above document is hereby made a part of these contract documents. Copies of this standard document are available from:

1. The American Institute of Architects
1735 New York Ave., N.W.
Washington, D.C. 20006
2. AIA North Carolina
14 East Peace St.
Raleigh, NC 27604
3. The East Group Architecture, P.A.
324 Evans St.
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**CITY OF GREENVILLE
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**Exhibit "A"
SUPPLEMENTARY CONDITIONS
TO GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION AIA DOCUMENT
A201 – 1997 EDITION**

The following supplements modify, change, delete from or add to the "General Conditions of the Contract Construction", AIA Document A201, 1997 Edition. Where any Article of the General Conditions is modified or any Paragraph, Subparagraph or Clause thereof is modified or deleted by these supplements, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in effect.

ARTICLE 3 CONTRACTOR

3.5 WARRANTY

3.5.2 Add the following Subparagraph: "The Contractor will assign to the Owner at the time of final completion of the Work, any and all manufacturer's warranties relating to materials and labor used in the Work and further agrees to perform the Work in such manner so as to preserve any and all such manufacturer's warranties."

3.6.1 Add the following at the end of the Subparagraph: "North Carolina and county sales taxes are included within the Contract Sum and are not in addition to the Contract Sum. The Contractor shall make a monthly accounting of the taxes paid so the Owner may file for reimbursement."

3.18 INDEMNIFICATION

3.18.1 In line 8 after the words "(other than the Work itself)" delete "but only to the extent caused by the negligent acts or omissions" and substitute "caused by acts or omissions of".

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

4.3 CLAIMS AND DISPUTES

4.3.2 Add at the end of the Subparagraph: "Failure of the Contractor to give timely notice of a claim shall constitute waiver of the claim."

4.3.4 In Line 19 delete: ",subject to further proceedings pursuant to Paragraph 4.4."

4.3.7.2 Add at the end of the Clause: "Claims for extension of the Contract Time, described in Subparagraph 4.3.7.1 for "Bad Weather" shall be submitted by the Contractor for consideration by the Architect when the weather has an adverse effect on the scheduled construction only under the following conditions:

1. If the number of days during which there was in excess of .02 inches of rain per day, exceeds by 105% the average number of days during which there was in excess of .02 inches of rain per day for that same month for the immediately preceding five (5) years.

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2. If the number of days during which the temperature did not exceed 32.0° F in the period from 7:00 a.m. to 5:00 p.m., exceeds by 105% the average number of days during which the temperature did not exceed 32.0° F in the period from 7:00 a.m. to 5:00 p.m. for that same month for the immediately preceding five (5) years.

The Architect will not consider any claims for extension of time due to “Bad Weather”, except as outlined in this section.”

4.4 RESOLUTION OF CLAIMS AND DISPUTES

4.4.1 Delete 1st and 2nd sentences and substitute: “Claims shall be submitted to the Architect for decision. Notwithstanding any other provision of the Contract, the Architect will render to the parties the Architect's written decision relative to the claim, including any change in the Contract Sum or Contract Time or both, within 30 days after the claim is made, unless the Architect is granted an extension of time to render a decision by mutual agreement of the parties.”

4.4.5 Delete the Subparagraph as written and substitute: “The Architect will approve or reject Claims by written decision. The decision shall state the reasons for approval or rejection and shall notify the parties of any change in the Contract Sum or Contract Time or both. The decision of the Architect shall be final and binding on the parties but subject to voluntary arbitration or litigation.”

4.4.6 Delete this Subparagraph in its entirety.

4.4.8 Delete: “,by mediation or by arbitration.”

4.5 MEDIATION

Delete this Paragraph in its entirety.

4.6 ARBITRATION

Delete this Paragraph in its entirety.

ARTICLE 5 SUBCONTRACTORS

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

5.2.3 Delete the 2nd sentence and substitute: “If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum shall be increased by the lesser of the following: (1) the difference between the subcontract amount proposed by the person or entity recommended by the Contractor and the subcontract amount proposed by the person or entity accepted or designated by the Owner and the Architect; or (2) the amount by which the subcontract amount proposed by the person or entity accepted or designated by the Owner and the Architect exceeds the amount set forth in the Schedule of Values, if any, which is applicable to the Work

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covered by such subcontract.”

5.3 SUBCONTRACTUAL RELATIONS

5.3.1 Add at the end of the Subparagraph: “The agreement between the Contractor and Subcontractor shall include but are not limited to the requirements of liability insurance and workers’ compensation insurance either as part of the Contractor’s policies or by separate policy provided by the Subcontractor, an indemnification agreement for injuries or damages caused by the acts or omissions of the Subcontractor, and that no privity exists between the Subcontractor and the Owner.”

ARTICLE 7 CHANGES IN THE WORK

7.1 GENERAL

7.1.3 At the end of the Subparagraph: “Except as permitted in Paragraph 7.3 and Subparagraph 9.7.1, a change in the Contract Sum or the Contract Time shall be accomplished only by Change Order. Accordingly, no course of conduct or dealings between the parties, nor express or implied acceptance of alterations or additions to the Work, and no claim that the Owner has been unjustly enriched by any alteration or addition to the Work, whether or not there is, in fact, any unjust enrichment to the Work, shall be the basis of any claim to an increase in any amounts due under the Contract Documents or a change in any time period provided for in the Contract Documents.”

7.2 CHANGE ORDERS

7.2.3 Add the following Subparagraph: “Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work which is the subject of the Change Order, including, but not limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contact Sum and the construction schedule. In the event a Change Order increases the Contract Sum, Contractor shall include the Work covered by such Change Orders in Applications for Payment as if such Work were originally part of the Contract Documents.”

7.3 CONSTRUCTION CHANGE DIRECTIVES

7.3.10 Add the following Subparagraph: “The term, "allowance for overhead and profit," wherever mentioned in this Contract, shall be limited by the following conditions:

"Overhead Costs" shall include the following: Supervision, superintendent, wages of timekeepers, watchmen and clerks, hand tools, incidentals, general office expense, and all other expenses not included in "cost" as defined in Subparagraph 7.3.6 and including all costs associated with time extensions granted as a part of change orders.

Overhead and profit shall not exceed 15% of the value of labor and material for Work performed by the Contractor. If the work is performed by a Subcontractor, the Contractor’s overhead and profit shall not exceed 7 ½ %.”

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ARTICLE 8 TIME

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.1 In Line 5 delete: "pending mediation and arbitration, or".

ARTICLE 9 PAYMENTS AND COMPLETION

9.7 FAILURE OF PAYMENT

9.7.1 In Line 4, delete the phrase: "or awarded by arbitration".

9.8 SUBSTANTIAL COMPLETION

9.8.1 Add after the phrase "for its intended use": "; provided, however, that as a condition precedent to Substantial Completion, the Owner has received all certificates of occupancy and any other permits, approvals, licenses, and other documents from any governmental authority having jurisdiction thereof necessary for the beneficial occupancy of the Project."

9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.1 Add at the end of the Subparagraph: "All warranties and guarantees required under or pursuant to the Contract Documents shall be assembled and delivered by the Contractor to the Architect as part of the final Application for Payment. The final Certificate for Payment will not be issued by the Architect until all warranties and guarantees have been received by the Owner."

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

10.1.1 Add at the end of the Subparagraph: "In no event, however, shall the Owner have any responsibility for any substance or material that is brought to the Project site by the Contractor, any Subcontractor, any materialman or supplier or any entity for whom any of them is responsible. The Contractor agrees not to use any fill or other materials to be incorporated into the Work which are hazardous, toxic or comprised of any items that are hazardous or toxic."

ARTICLE 11 INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

11.1.2.1 Add the following Clause: "The insurance required by Subparagraph 11.1.1 shall be written with an "A" rated company and written for not less than the following, or greater if required by law:

1. Worker's Compensation – State, Statutory

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2. Comprehensive General Liability (including Premises – Operations; Independent Contractors’ Protective; Products and Completed Operations; All Risk Property Damage):
 - a. Bodily Injury/Property Damage: \$2,000,000 each occurrence
\$2,000,000 annual aggregate
 - b. Property Damage Liability Insurance will provide X, C, or U coverage as applicable.
3. Contractual Liability:
 - a. Bodily Injury/Property Damage: \$2,000,000 each occurrence
\$2,000,000 annual aggregate
4. Personal Injury, with Employment Exclusion deleted
- \$1,000,000 annual aggregate
5. Comprehensive Automobile Liability:
 - a. Bodily Injury/Property Damage: \$1,000,000 each person
\$1,000,000 each occurrence

11.3 PROJECT MANAGEMENT PROTECTIVE LIABILITY INSURANCE

11.3.3 Delete this Subparagraph in its entirety.

11.4 PROPERTY INSURANCE

11.4.1 In the first sentence, delete “Unless otherwise provided, the Owner “ and substitute “The Contractor”. Add at the end of the Subparagraph:

“The form of policy for this coverage shall be completed value. If the Owner is damaged by the failure of the Contractor to maintain such insurance, then the Contractor shall bear all reasonable costs properly attributable thereto.”

11.4.1.2 Delete Clause 11.4.1.2 in its entirety.

11.4.1.3 Delete Clause 11.4.1.3 in its entirety.

11.4.4 Delete Subparagraph 11.4.4 in its entirety.

11.4.6 Delete Subparagraph 11.4.6 and substitute the following: “Before an exposure to loss may occur, the Contractor shall file with the Owner two (2) certified copies of the policy or policies providing this Property Insurance coverage, each containing those endorsements specifically related to the Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire until at least thirty (30) days prior written notice has been given to the Contractor.”

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11.4.7 Modify Subparagraph 11.4.7 by substituting “Contractor” for “Owner” at the end of the first sentence.

11.4.8 Modify Subparagraph 11.4.8 by substituting “Contractor” for “Owner” as fiduciary; except that at the first reference to “Owner” in the first sentence, the word “this” should be substituted for “Owner’s”.

11.4.9 Modify Subparagraph 11.4.9 by substituting “Contractor” for “Owner” each time the latter word appears and in line 5 delete the phrase “or in accordance with an arbitration award in which case the procedure shall be as provided in paragraph 4.6.”

11.4.10 Modify Subparagraph 11.4.10 by substituting “Contractor” for “Owner” each time the latter word appears and deleting all words in the Subparagraph after the word “power” in the third line.

END OF SUPPLEMENTARY CONDITIONS

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SECTION 01230 – ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

Alternate No.1 - Replace existing truck bay lights with LED lights activated by motion sensors.

Alternate No. 2 - Provide and install new overhead door motors and hardware as listed on Drawing A2.1.

END OF SECTION 01230

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SECTION 01250 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 20 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

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4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use AIA Document G709.

1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01250

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SECTION 01290 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including Application for Payment forms with Continuation Sheets.
 2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
1. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Dollar value.
 - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
 3. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 4. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 5. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 6. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

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7. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Stating that Surety agrees to payment of the sum requested, that the value of the work stated in the Contractor's request is a true statement, and that the sums requested for stored materials (if any) are correct.
 2. Provide Certified Sales Tax Report.
 3. Lien waivers.
 4. Proof of Payment Certification form (in accordance with section 00102).
 5. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements: See related sections below.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 48 hours. One copy shall include waivers of lien and similar attachments if required.
 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's Construction Schedule (preliminary if not final).
 4. Submittals Schedule (preliminary if not final).

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5. Certificates of insurance and insurance policies before construction starts.
 6. Performance and payment bonds before construction starts.
- G. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01290

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SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
1. General Project coordination procedures.
 2. Coordination Drawings.
 3. Project meetings.

1.2 COORDINATION

- A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
 2. Preparation of the Schedule of Values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.

1.3 SUBMITTALS

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1.4 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing.
 - d. Designation of responsible personnel.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for processing Applications for Payment.
 - g. Distribution of the Contract Documents.
 - h. Submittal procedures.
 - i. Preparation of Record Documents.
 - j. Use of the premises.
 - k. Responsibility for temporary facilities and controls.
 - l. Parking availability.
 - m. Office, work, and storage areas.
 - n. Equipment deliveries and priorities.
 - o. First aid.
 - p. Security.
 - q. Progress cleaning.
 - r. Working hours.
- C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.

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- c. Related Change Orders.
 - d. Purchases.
 - e. Deliveries.
 - f. Submittals.
 - g. Review of mockups.
 - h. Possible conflicts.
 - i. Compatibility problems.
 - j. Time schedules.
 - k. Weather limitations.
 - l. Manufacturer's written recommendations.
 - m. Warranty requirements.
 - n. Compatibility of materials.
 - o. Acceptability of substrates.
 - p. Temporary facilities and controls.
 - q. Space and access limitations.
 - r. Regulations of authorities having jurisdiction.
 - s. Testing and inspecting requirements.
 - t. Required performance results.
 - u. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements.
4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.
- 1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.

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- 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Change Orders.
 - 14) Documentation of information for payment requests.
3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
- a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

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SECTION 01315 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work Included This Section:

1. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
 - a) Pre-Construction Conference.
 - b) Coordination Meetings.
 - c) Progress Meetings.

1.2 PRE-CONSTRUCTION CONFERENCE

A. A pre-construction conference shall be scheduled by the Architect and held at the Project site or other convenient location after execution of the Agreement or Notice to Proceed, whichever comes first and prior to commencement of construction activities.

B. Attendees:

1. The Owner, Architect, the Contractor(s) and its superintendent(s) shall each be represented at the conference by persons authorized to conclude matters relating to the Work.

C. Agenda:

1. Discuss items of significance that could affect progress including such topics as:
 - a) Work sequencing.
 - b) Tentative construction schedule.
 - c) Designation of responsible personnel.
 - d) Procedures for processing Change Proposal Requests and Change orders.
 - e) Procedures for processing Applications for Payment.
 - f) Submittal of Shop Drawings, Product Data and Samples.
 - g) Preparation of record documents.
 - h) Use of the premises.
 - i) Staging areas.
 - j) Security.
 - k) Housekeeping.

1.3 COORDINATION MEETINGS

A. The General Contractor shall conduct project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special Pre-installation meetings.

B. Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting, such as the Owner and Architect.

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C. Weekly Progress Meetings:

1. To enable orderly review of progress during construction and to provide for systematic discussion of problems, weekly project meetings shall be held throughout the construction period.
2. Persons designated by each Subcontractor shall attend and participate in weekly project meetings shall have all required authority to commit the Contractor or Subcontractor to decisions agreed upon in the project meetings.
3. The General Contractor shall conduct the meetings, compile minutes of each meeting and will distribute copies to the Owner and the Architect. The General Contractor shall distribute such other copies as he wishes. Each Contractor shall, to the maximum extent practicable, assign the same person or persons to represent the Contractor or Subcontractor at project meetings throughout the construction period.

D. Owner, Architect, Contractor (OAC) Project Meetings:

1. To enable orderly review of progress during construction and to provide for systematic discussion of problems, project meetings shall be held throughout the construction period at intervals determined prior to construction.
2. The General Contractor shall attend and participate in the OAC project meetings and shall have all required authority to commit the Contractor and Subcontractor(s) to decisions agreed upon in the project meetings.
3. The Architect will conduct the OAC meetings and compile minutes of each meeting and will distribute copies to the Owner and Contractor. The Contractor shall distribute such other copies as required. The General Contractor shall, to the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout the construction period.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01315

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SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.
- B. See Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
- C. See Division 1 Section "Closeout Procedures" for submitting warranties Project Record Documents and operation and maintenance manuals.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 - 3. Submittals shall be made in digital (pdf) form via email to the Architect. Paper copies of submittals are not required or desired and will not be acted upon.
- B. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- C. 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.
 - 1. If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 2. Allow 14 days for processing each resubmittal.
 - 3. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- D. Identification: Include the following information with each submittal for identification.

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1. Indicate name of firm or entity that prepared each submittal.
 2. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of supplier.
 - d. Name of manufacturer.
 - e. Unique identifier, including revision number.
 - f. Number and title of appropriate Specification Section.
 - g. Drawing number and detail references, as appropriate.
 - h. Other necessary identification.
- E. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- F. Transmittal: Send each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a digital transmittal form.
- G. Architect will not review submittals received from sources other than Contractor.
- H. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
1. Number of Copies: Submit 1 digital copy in pdf format via email. Architect will return a digital copy via email.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. Mark each copy of each submittal to show which products and options are applicable.
 2. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Manufacturer's catalog cuts.
 - e. Wiring diagrams showing factory-installed wiring.
 - f. Printed performance curves.
 - g. Operational range diagrams.
 - h. Compliance with recognized trade association standards.

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- i. Compliance with recognized testing agency standards.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
- 1. Preparation: Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Notation of coordination requirements.
 - j. Notation of dimensions established by field measurement.
 - 2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
- D. Samples: Prepare physical units of materials or products, including the following:
- 1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
 - 2. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 - 3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Submit 3 sets of Samples. Architect will retain 1 Sample set; 2 will be returned to contractor, one of which will remain at job site.
 - 4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side.
 - 5. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
 - 6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
- E. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location.

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- F. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 - 1. Number of Copies: Submit 1 digital submittal in pdf format via email.
 - 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - 3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."
- B. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."
- C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
- E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
- F. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- G. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
- H. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- I. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures."
- J. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- K. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.

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- L. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections.
- M. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- C. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- D. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken:
- E. Informational Submittals: Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- F. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION 01330

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SECTION 01400 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. See Divisions 2 through 16 Sections for specific test and inspection requirements.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.3 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.

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9. Test and inspection results and an interpretation of test results.
10. Ambient conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.
- E. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.
- F. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

1.5 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

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- B. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ the same entity engaged by Owner, unless agreed to in writing by Owner.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
 5. Do not perform any duties of Contractor.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

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- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
 - 2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01400

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SECTION 01420 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Installer": Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- J. "Experienced": When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- K. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

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1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
- C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
 - 1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.
- D. Copies of Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source and make them available on request.
- E. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

ADAAG	Americans with Disabilities Act (ADA)
CFR	Code of Federal Regulations
CRD	Handbook for Concrete and Cement
DOD	Department of Defense Specifications and Standards
FED-STD	Federal Standard (See FS)
FS	Federal Specification
FTMS	Federal Test Method Standard (See FS)
MILSPEC	Military Specification and Standards
UFAS	Uniform Federal Accessibility Standards

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1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

AA	Aluminum Association, Inc. (The)
AAADM	American Association of Automatic Door Manufacturers
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AAN	American Association of Nurserymen (See ANLA)
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists (The)
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute/ACI International
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies, Inc. (The)
AFPA	American Forest & Paper Association (See AF&PA)
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AGC	Associated General Contractors of America (The)
AHA	American Hardboard Association
AHAM	Association of Home Appliance Manufacturers
AI	Asphalt Institute
AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction

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ALCA	Associated Landscape Contractors of America
ALSC	American Lumber Standard Committee
AMCA	Air Movement and Control Association International, Inc.
ANLA	American Nursery & Landscape Association (Formerly: AAN - American Association of Nurserymen)
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts
APA	APA - The Engineered Wood Association
APA	Architectural Precast Association
API	American Petroleum Institute
ARI	Air-Conditioning & Refrigeration Institute
ASCA	Architectural Spray Coaters Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International (The American Society of Mechanical Engineers International)
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International (American Society for Testing and Materials International)
AWCI	AWCI International (Association of the Wall and Ceiling Industries International)
AWCMA	American Window Covering Manufacturers Association (See WCMA)
AWI	Architectural Woodwork Institute
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International)

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CCC	Carpet Cushion Council
CCFSS	Center for Cold-Formed Steel Structures
CDA	Copper Development Association Inc.
CEA	Canadian Electricity Association
CFFA	Chemical Fabrics & Film Association, Inc.
CGA	Compressed Gas Association
CGSB	Canadian General Standards Board
CIMA	Cellulose Insulation Manufacturers Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CPPA	Corrugated Polyethylene Pipe Association
CRI	Carpet & Rug Institute (The)
CRSI	Concrete Reinforcing Steel Institute
CSA	CSA International (Formerly: IAS - International Approval Services)
CSI	Construction Specifications Institute (The)
CSSB	Cedar Shake & Shingle Bureau
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)
DHI	Door and Hardware Institute
EIA	Electronic Industries Alliance
EIMA	EIFS Industry Members Association
EJMA	Expansion Joint Manufacturers Association, Inc.
FCI	Fluid Controls Institute
FGMA	Flat Glass Marketing Association (See GANA)
FM	Factory Mutual System (See FMG)
FMG	FM Global (Formerly: FM - Factory Mutual System)

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FSC	Forest Stewardship Council
GA	Gypsum Association
GANA	Glass Association of North America (Formerly: FGMA - Flat Glass Marketing Association)
GRI	Geosynthetic Research Institute
GTA	Glass Tempering Division of Glass Association of North America (See GANA)
HI	Hydraulic Institute
HI	Hydronics Institute
HMMA	Hollow Metal Manufacturers Association (See NAAMM)
HPVA	Hardwood Plywood & Veneer Association
HPW	H. P. White Laboratory, Inc.
IAS	International Approval Services (See CSA)
ICEA	Insulated Cable Engineers Association, Inc.
ICRI	International Concrete Repair Institute, Inc.
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
IESNA	Illuminating Engineering Society of North America
IGCC	Insulating Glass Certification Council
IGMA	Insulating Glass Manufacturers Alliance (The)
ILI	Indiana Limestone Institute of America, Inc.
ISSFA	International Solid Surface Fabricators Association
I3A	International Imaging Industry Association (Formerly: PIMA - Photographic & Imaging Manufacturers Association)
ITS	Intertek Testing Services
IWS	Insect Screening Weavers Association (Now defunct)
KCMA	Kitchen Cabinet Manufacturers Association
LMA	Laminating Materials Association (Formerly: ALA - American Laminators Association)
LPI	Lightning Protection Institute

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LSGA	Laminated Safety Glass Association (See GANA)
MBMA	Metal Building Manufacturers Association
MFMA	Maple Flooring Manufacturers Association
MFMA	Metal Framing Manufacturers Association
MHIA	Material Handling Industry of America
MIA	Marble Institute of America
ML/SFA	Metal Lath/Steel Framing Association (See SSMA)
MPI	Master Painters Institute
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NAAMM	North American Association of Mirror Manufacturers (See GANA)
NACE	NACE International (National Association of Corrosion Engineers International)
NAIMA	North American Insulation Manufacturers Association (The)
NAMI	National Accreditation and Management Institute, Inc.
NBGQA	National Building Granite Quarries Association, Inc.
NCMA	National Concrete Masonry Association
NCPI	National Clay Pipe Institute
NCTA	National Cable & Telecommunications Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFPA	National Fire Protection Association
NFRC	National Fenestration Rating Council
NGA	National Glass Association

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NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	National Oak Flooring Manufacturers Association
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSA	National Stone Association (See NSSGA)
NSF	NSF International (National Sanitation Foundation International)
NSSGA	National Stone, Sand & Gravel Association (Formerly: NSA - National Stone Association)
NTMA	National Terrazzo and Mosaic Association, Inc.
NWWDA	National Wood Window and Door Association (See WDMA)
PCI	Precast/Prestressed Concrete Institute
PDCA	Painting and Decorating Contractors of America
PDI	Plumbing & Drainage Institute
PGI	PVC Geomembrane Institute
RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service
SAE	SAE International
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SGCC	Safety Glazing Certification Council
SIGMA	Sealed Insulating Glass Manufacturers Association (See IGMA)
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPFA	Spray Polyurethane Foam Alliance

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(Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.;
Spray Polyurethane Foam Division)

SPIB	Southern Pine Inspection Bureau (The)
SPI/SPFD	Society of the Plastics Industry (The) Spray Polyurethane Foam Division (See SPFA)
SPRI	SPRI (Single Ply Roofing Institute)
SSINA	Specialty Steel Industry of North America
SSMA	Steel Stud Manufacturers Association (Formerly: ML/SFA - Metal Lath/Steel Framing Association)
SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWI	Steel Window Institute
SWRI	Sealant, Waterproofing, and Restoration Institute
TCA	Tile Council of America, Inc.
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance
TPI	Truss Plate Institute
TPI	Turfgrass Producers International
UL	Underwriters Laboratories Inc.
UNI	Uni-Bell PVC Pipe Association
USITT	United States Institute for Theatre Technology, Inc.
WASTECH	Waste Equipment Technology Association
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association (See WCSC)
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association)
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association)
WIC	Woodwork Institute of California
WMMPA	Wood Moulding & Millwork Producers Association
WWPA	Western Wood Products Association

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- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

BOCA	BOCA International, Inc.
CABO	Council of American Building Officials (See ICC)
IAPMO	International Association of Plumbing and Mechanical Officials (The)
ICBO	International Conference of Building Officials
ICC	International Code Council, Inc. (Formerly: CABO - Council of American Building Officials)
SBCCI	Southern Building Code Congress International, Inc.

- D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

CE	Army Corps of Engineers
CPSC	Consumer Product Safety Commission
DOC	Department of Commerce
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
GSA	General Services Administration
HUD	Department of Housing and Urban Development
LBL	Lawrence Berkeley Laboratory (See LBNL)
LBNL	Lawrence Berkeley National Laboratory
NCHRP	National Cooperative Highway Research Program (See TRB)
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety & Health Administration
PBS	Public Building Service (See GSA)
RUS	Rural Utilities Service (See USDA)

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TRB	Transportation Research Board
USDA	Department of Agriculture
USPS	Postal Service

- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

CAPUC	(See CPUC)
CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation
CPUC	California Public Utilities Commission
TFS	Texas Forest Service Forest Products Laboratory

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01420

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SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

1.2 USE CHARGES

- A. General: All temporary facilities shall be provided by contractor for General Work. Cost and use charges for all temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum for the General Contractor's work. Allow other entities to use temporary services and facilities without cost, including, but not limited to, other prime contractors, Owner's construction forces, Architect, testing and inspecting agencies, and personnel of authorities having jurisdiction.

1.3 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
 - 1. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

- A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
 - 1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.
- B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
 - 1. Keep temporary services and facilities clean and neat.
 - 2. Relocate temporary services and facilities as required by progress of the Work.

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PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

2.2 EQUIPMENT

- A. Field Offices: Mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.
- B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- C. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- D. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water, drinking-water units, including paper cup supply.
- E. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.

- 1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.

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2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.
3. Drinking-Water Facilities: Provide bottled-water, drinking-water units.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
 2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion.
- B. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section "Execution Requirements " for progress cleaning requirements.
 1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
- C. Lifts and Hoists: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.
- B. Tree and Plant Protection: Install temporary fencing or other measures as needed to protect existing trees and landscaping from damage.
- C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

END OF SECTION 01500

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SECTION 01600 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for selecting products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. See Division 1 Section "Closeout Procedures" for submitting warranties for contract closeout.
- C. See Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.
- D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.3 SUBMITTALS

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- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use CSI Form 131 A .
 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time.
 - j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 21 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
 - a. Form of Acceptance: Change Order.
 - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

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1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 5. Store products to allow for inspection and measurement of quantity or counting of units.
 6. Store materials in a manner that will not endanger Project structure.
 7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 9. Protect stored products from damage.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

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2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

2.2 PRODUCT SUBSTITUTIONS

- A. See Requirements of specification section 01631

PART 3 - EXECUTION (Not Used)

END OF SECTION 01600

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SECTION 01631 - PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work Specified This Section:

1. This Section specifies administrative and procedural requirements for handling requests as a substitution request made after the Notice to Proceed or award of the Contract as a CPR.
2. All requests for substitution shall be made no later than 15 days after Notice to Proceed in order to be considered.

1.2 SUBMITTALS

A. Substitution Request Submittal:

1. Submit 1 digital copy of each request for substitution for consideration.
2. Submit each request on the attached form and in accordance with procedures required for Change Proposal Requests (CPR). See Section 01250 for additional information.
3. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
4. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 - a) Original copies of Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
 - b) Samples, where applicable or requested.
 - c) A detailed point by point comparison of the proposed substitution and the specified product detailing the significant qualities of both products.
 - 1) Significant qualities may include elements such as size, weight, durability, performance and visual effect.
 - d) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
 - e) A statement indicating the substitutions effect on the Contractor's Construction Schedule.
 - f) Cost information, including a proposal of the net deduct change in the Contract Sum.
 - g) Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that the product/assembly will perform adequately in the application indicated.
 - 1) Include the Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

B. Architect's Action:

1. After receipt of the request for substitution, the Architect may request additional information or documentation necessary for evaluation of the request.
2. If a decision on use of a proposed substitute is not made or obtained within sufficient time to have no adverse impact on the construction schedule, the Contractor shall use the product specified in the Contract Documents.

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PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 SUBSTITUTIONS:

A. Conditions:

1. No substitution will be considered unless such request include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for a complete comparison with the specified products or materials and an evaluation of the proposed products or materials.
 2. A statement setting forth changes in other materials, equipment or other portions of the Work including changes in the work of other contracts that incorporation of the proposed substitution would require shall be included.
 3. Savings or Credit to Owner for accepting substitution
 4. The burden of proof of the merit of the proposed substitution is upon the proposer.
 5. In addition to the requirements in the Supplemental General Conditions, the following items will apply:
 - a) The substitution is in compliance with subsequent interpretations of code or insurance requirements.
 - b) The manufacturer or fabricator shall certify or guarantee the specified product as required by the Contract Documents.
 - c) Product shall perform properly and fit in the designated space.
- B. The Contractor shall bear all expenses resulting from substitutions including the cost of work in general, structural, plumbing, mechanical and electrical trades required due to the substitution and the cost of any Architect's services made necessary by the substitution.
- C. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

3.2 SUBMITTAL FORMS:

- A. All proposed substitutions shall use the following form.

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**SUBSTITUTION
REQUEST**

Project: _____ Substitution Request No. _____

CPR No. (After Bid) _____

From: _____
To: _____ Date: _____

A/E Project No. _____
Re: _____ Contract For: _____

Specification Title/or Drawing Sheet: _____
Section No.: _____ Page No.: _____ Article/Paragraph: _____

Proposed Substitution: _____
Manufacturer: _____ Address: _____ Phone #: _____
Trade Name: _____ Model #: _____
Installer: _____ Address: _____ Phone #: _____

History: New Product: 2 -5 years old 5-10 years old More than ten years old

Briefly explain differences between proposed substitution and specified product _____

Point-by-Point comparative data attached - REQUIRED BY A/E

Reason for not providing specified item: _____

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Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

Telephone: _____ Owner Representative: _____

Date Installed: _____

Proposed substitution affects other parts of Work: No Yes; explain _____

Savings or Credit to Owner for accepting substitution: _____ (\$ _____)

(MUST BE FILLED OUT TO RECEIVE REVIEW.)

Proposed substitution changes Contract Time: No Yes; Add/Deduct _____ days.

Supporting Data Attached:

Product Data Drawings Tests Reports Samples _____

Fire Tests Acoustical Tests

ASTM Tests UL, FM or WHI listed: provide copy of test reports.

Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same or better warranty will be furnished for proposed substitution as for specified product.
- Same or better maintenance service and source of replacement parts, as applicable is available.
- Proposed substitution will not affect or delay Progress Schedule.
- Cost data as stated above is complete. Contractor (s) claims for additional costs related to accepted substitution, which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for A/E changes to building design, including architectural or engineering design, detailing, and construction costs caused by the requested substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted By: _____

Signature: _____

Firm: _____

Address: _____

Telephone: _____ Approved By: _____

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General Contractor

Date

Attachments: _____

ARCHITECT'S REVIEW AND ACTION

Substitution approved - Make submittals in accordance with Division One.

Substitution approved as noted - Make submittals in accordance with Division One.

Substitution rejected - Use specified materials.

Signed by: _____ Date: _____

Additional Comments Contractor Subcontractor Supplier Manufacturer A/E _____

END OF SECTION 01631

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**CITY OF GREENVILLE
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SECTION 01700 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. General installation of products.
 - 4. Progress cleaning.
 - 5. Starting and adjusting.
 - 6. Protection of installed construction.
 - 7. Correction of the Work.

- B. See Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.

- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
 - 1. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

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- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 3. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Owner not less than 7 days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's written permission.
- C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

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- E. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
- F. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- G. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.5 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01700

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SECTION 01731 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. See Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
- C. Requirements in this Section apply to mechanical and electrical installations. See Divisions 15 and 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.2 SUBMITTALS

1.3 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- C. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.4 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

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1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

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3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 3. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION 01731

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SECTION 01732 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 QUALITY ASSURANCE

Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

- A. Standards: Comply with ANSI A10.6 and NFPA 241.

1.4 PROJECT CONDITIONS

- A. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- B. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.
 - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
- C. Hazardous Materials: The owner will identify and remove all hazardous materials requiring removal.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities that are incorporated in new work and protect them against damage during selective demolition operations.

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1.5 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with requirements for access and protection specified in Division 1 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.3 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

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1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 5. Dispose of demolished items and materials promptly.
- B. Reuse of Building Elements: Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Comply with requirements specified in Division 1 Section "Construction Waste Management."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.5 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 01732

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SECTION 01770 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Project Record Documents.
 - 3. Operation and maintenance manuals.
 - 4. Warranties.
 - 5. Instruction of Owner's personnel.
 - 6. Final cleaning.
- B. See Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
- C. See Division 1 Section "Construction Progress Documentation" for submitting Final Completion construction photographs and negatives.
- D. See Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for products of those Sections.

1.2 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 8. Complete startup testing of systems.
 - 9. Submit test/adjust/balance records.
 - 10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 11. Advise Owner of changeover in heat and other utilities.

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12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.3 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit one digital copy of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1.5 PROJECT RECORD DOCUMENTS

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- A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.
- B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.
 - 1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
 - b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - 2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 - 3. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
 - 4. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
- C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Note related Change Orders and Record Drawings, where applicable.
- D. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.6 OPERATION AND MAINTENANCE MANUALS

- A. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
 - 1. Operation Data: Include emergency instructions and procedures, system and equipment descriptions, operating procedures, and sequence of operations.
 - 2. Maintenance Data: Include manufacturer's information, list of spare parts, maintenance procedures, maintenance and service schedules for preventive and routine maintenance, and copies of warranties and bonds.

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- B. Organize operation and maintenance manuals into digital files for each system or assembly and digitally submit to Architect with a transmittal describing contents.

1.7 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual and submit digital files of each warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING

- A. Instruction: Instruct Owner's personnel to maintain systems, and subsystems.
 - 1. Provide instructors experienced in operation and maintenance procedures.
 - 2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
 - 3. Schedule training with Owner, through Architect, with at least 21 days' advance notice.
 - 4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.

3.2 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

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1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - g. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - h. Leave Project clean

- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770

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SECTION 01788 - WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work Included This Section:

1. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
2. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections of Divisions 2 through 16.
3. Certifications and other commitments and agreements for continuing services to Owner are specified in the Contract Documents.

B. Disclaimers and Limitations:

1. Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign warranties with the Contractor.
2. At no time shall any warranties/guarantees be submitted to the Owner for this project which supercedes or voids any of the Owners rights as established by the state's General Statutes for which the project is located.
3. Failure of the Contractor and/or its suppliers, manufacturers and its sub-contractors to enter into such warranties as required by the Contract Documents shall be considered a breach of contract.

1.2 WARRANTY REQUIREMENTS

A. Related Damages and Losses:

1. When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work. Do not reuse damaged materials.

1.3 SUBMITTALS

A. Written Warranties:

1. Submit written warranties to the Architect prior to Substantial Completion in a separate three ring binder. The Architect's Certificate of Substantial Completion designates a commencement date for warranties.
2. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or the Contractor and subcontractor, supplier or manufacturer.
3. Refer to individual Sections for specific content requirements, and particular requirements for submittal of special warranties.

B. Form of Submittal:

1. At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or

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manufacturer. Deliver all warranties to the Architect before or with the Request for Substantial Completion.

C. Reinstatement of Warranty:

1. When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement.
2. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

D. Replacement Cost:

1. Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents.
2. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of Work through a portion of its anticipated useful service life.

E. Owner's Recourse:

1. Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

F. Rejection of Warranties:

1. The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01788

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PART 2 - PRODUCTS

2.1 SILT FENCES

- A. Posts: Steel posts shall be 5' in height and be of self-fastener angle steel type.
- B. Posts shall be spaced at 8' maximum when silt fence is backed with wire mesh, and 6' when no wire mesh is used or as required by the Engineer.
- C. Woven Wire: Woven wire fencing shall conform to ASTM A116 for Class 3 galvanizing. Fabric shall be a minimum of 32" in width and shall have a minimum of 6 line wires with 12" stay spacing. The top and bottom wires shall be 10 gauge while the intermediate wires shall be 12-1/2 gauge. Wire fabric shall be fastened to wood posts with not less than 9 wire staples 1-1/2" long.
- D. Fabric: Provide woven synthetic fiber designed specifically for silt fence conforming to NCDOT specifications.

2.2 DRAINAGE STONE

- A. Class I material NCDOT No. 57.

2.3 TEMPORARY SEEDING:

- A. Temporary seeding, when required, shall be performed in accordance with the recommendations contained in "Guide for Sediment Control on Construction Sites in North Carolina", published by the Soil Conservation Service and Section 02228 of these specifications.

PART 3 - EXECUTION

3.1 GENERAL

The Contractor shall take whatever measures are necessary to minimize soil erosion and siltation, and water, air, and noise pollution caused by his operations. The Contractor shall also comply with the applicable regulations of all legally constituted authorities relating to pollution prevention and control. The Contractor shall keep himself fully informed of all such regulations which in any way affect the conduct of the work, and shall at all times observe and comply with all such regulations. In the event of conflict between such regulations and the requirements of the specifications, the more restrictive requirements shall apply.

3.2 EROSIONS AND SILTATION CONTROL

- A. The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent the eroding of soil and the silting of rivers, streams, lakes, reservoirs, other water impoundments, ground surfaces, or other property.
- B. Prior to suspension of operations on the project or any portion thereof, the Contractor shall take all necessary measures to protect the construction area, including but not limited to borrow sources, soil type base course sources, and waste areas, from erosion during the period of suspension.
- C. Provide diversion ditches and berms as necessary to prevent concentrated flow of water across disturbed areas.
- D. Stockpile excavated material on the opposite side of the utility trenches from the watercourses to the extent that is possible.

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- E. In the event that stockpiles are placed on the watercourse side of the trench, provide silt fence or silt berms with stone filter outlets along the entire length of the stockpile that is on the watercourse side of the trench. Upon the completion of backfilling, the measures shall be removed and the site graded to its natural grade or as shown on plans.
- F. Maintain natural buffer zones along all watercourses sufficient to retain all visible siltation within the first 25 percent of the buffer width.
- G. Provide a settling basin with a gravel filter outlet for all water pumped from trenches or dewatering equipment. Pumping of that water directly into any stream, pond, or watercourse is prohibited.
- H. Temp, fertilize, seed and mulch the disturbed areas as soon as practicable after line is installed and, in all cases, no later than 21 days after completion of the line segment or work at a particular site.
- I. When construction operations are suspended for more than 21 days, provide temporary seeding and mulching of all disturbed areas including those areas in which further construction is necessary.
- J. Erosion control measures installed by the Contractor shall be acceptably maintained by the Contractor.
- K. Silt fences shall be provided where shown on the drawings and/or as necessary to prevent erosion.
- L. Catch basins shall be protected from silt by placing straw bales or silt fence around the opening until vegetative cover is established.

3.3 WATER AND AIR POLLUTION

- A. The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent pollution of rivers, streams, and water impoundments. Pollutions such as chemicals, fuels, lubricants, bitumens, raw sewage, and other harmful waste shall not be discharged into or alongside of rivers, streams, or impoundments, or into natural or manmade channels leading thereto.

3.4 DUST CONTROL

- A. The Contractor shall control dust throughout the life of the project within the project area and at all other areas affected by the construction of the project, including, but not specifically limited to, unpaved secondary roads, haul roads, access roads, disposal sites, borrow and material sources, and production sites. Dust control shall not be considered effective where the amount of dust creates a potential or actual unsafe condition, public nuisance, or condition endangering the value, utility, or appearance of any property.

3.5 NOISE CONTROL

- A. The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent excessive and unnecessary noise. The Contractor shall choose his methods so as to minimize the disturbance of area residents.

END OF SECTION 02120

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SECTION 02228 - CLEAN-UP AND SEEDING

PART 1 - GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

- A. Erosion Control: Section 02120

1.2 DESCRIPTION

- A. The work covered by this section consists of disposal of waste and debris, preparing seedbeds, furnishing, placing, and covering limestone, fertilizer, and seed; compacting seedbeds; furnishing, placing, and securing mulch; and other operations necessary for the permanent establishment of grasses from seed; all in accordance with these specifications and drawings.
- B. Waste will be considered to be all excavated materials which are not utilized in the construction of the project.
- C. Debris will be considered to be all undesirable material encountered or left on the project site.
- D. Permanent Seeding is required for all areas disturbed by construction, except for areas covered by structures, pavements, etc.
- E. Temporary Seeding of disturbed areas shall be performed whenever one or more of the following conditions exist.
 - 1. The Engineer determines that temporary seeding is necessary to prevent or stop erosion of disturbed areas.
 - 2. Work is suspended or delayed on any portion of the project for 15 calendar days (10 calendar days within NCDOT right of way) and the potential for erosion exists.
 - 3. Whenever permanent seeding is delayed beyond that required by the Contract Documents.
- F. The Contractor shall adapt his operations to variations in weather or soil conditions as necessary for the successful establishment and growth of the grasses.
- G. In all operations covered by this section, care shall be taken to preserve the required line, grade, and cross section of the work area.

1.3 QUALITY ASSURANCE

- A. All work done in this section shall be performed in accordance with all applicable Sections and Provisions of the North Carolina State Department of Transportation Standard Specifications for Roads and Structures, latest revision.
- B. All materials required in this section shall meet or exceed the requirements of Division X: Section 1060 of the North Carolina State Department of Transportation Standard Specifications for Roads and Structures, latest revision.

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PART 2 - PRODUCTS

2.1 MATERIALS

A. Fertilizer:

1. Provide commercial fertilizer conforming to statutory requirements and all rules and regulations adopted by the North Carolina Board of Agriculture for all seeding/sodding.

B. Limestone: Provide agricultural limestone conforming to all statutory requirements and all rules and regulations adopted by the North Carolina Board of Agriculture.

C. Seed: Provide seed conforming to all statutory requirement and all rules and regulations adopted by the North Carolina Board of Agriculture.

1. Provide seed in accordance with requirements shown below. Deliver to site in original containers, labeled to show that the requirements of the N.C. Seed Law are met.
2. Quality of seed shall conform to the following:

<u>Common Name</u>	<u>Minimum Seed Purity</u> %	<u>Minimum Germination</u> %	<u>Maximum Weed Seed</u> %
<u>Grasses</u>			
Fescue Tall (KY.-31)	98	90	1.00
Common Bermudagrass	98	90	1.00

3. Seed containing prohibited noxious weed seed shall not be accepted. Seed shall be in conformance with state seed law restrictions for restricted noxious weeds.
4. If seed of the accepted quality cannot be bought, secure prior approval before making changes or exceptions.

D. Mulch:

1. Mulch for erosion control shall consist of grain straw or other acceptable material, and shall have been approved by the Architect/Engineer before being used. All mulch shall be reasonably free from mature seedbearing stalks, roots, or bulblets of Johnson Grass, Nutgrass, Sandbur, Wild Garlic, Wild Onion, Bermuda Grass, Cortalaria, and Witch weed, and free of excessive amount of restricted noxious weeds as defined by the North Carolina Board of Agriculture at the time of use of the mulch. Also there shall be compliance with all applicable State and Federal domestic plant quarantines. Straw mulch that is matted or lumpy shall be loosened and separated before being used.
2. Material for holding mulch in place shall be asphalt or other approved binding material applied in accordance with this section.

PART 3 – EXECUTION

3.1 GENERAL

- A. Follow procedures set forth in the publication “Guide for Sediment Control on Construction Sites in North Carolina” by the United States Department of Agriculture, Soil Conservation Service, and as specified herein.

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- B. Scarify soil to a depth of three (3) inches and work into a satisfactory seed bed by disking, use of cultipackers, harrows, drags and other approved means.
- C. Preparation outlined above shall not be done when the soil is frozen, wet or otherwise in an unfavorable condition.
- D. Begin and complete seeding operations as outlined below as soon as possible after final grading is completed, but in no event later than 15 calendar days after completion of final grading.
- E. Disturbed areas within the right of way of the North Carolina Department of Transportation shall be graded, dressed, seeded, mulched, and tacked with liquid asphalt or other approved means within 10 calendar days of completion of work in any area.
- F. Seeding and mulching operations shall not begin until electrical service has been installed within the project, unless directed by the Engineer.
- G. Distribute lime and fertilizer, uniformly over seed bed and harrow, rake, or otherwise work same into seed beds.
- H. Distribute seed uniformly over seed bed. Cover seed lightly after seeding.
- I. No lime, fertilizer, or seed shall be applied during a strong wind, when soil is wet or otherwise unworkable. Should rain follow seeding before rolling is begun, the bed shall not be rolled.
- J. The kinds of seed and the rates of application of seed, fertilizer, and limestone shall be as stated below.
 - 1. Seeding Schedule: See L2.1

3.2 WASTE MATERIAL DISPOSAL

- A. Waste material not utilized in the construction of the project shall be removed from the project site and disposed of by the Contractor in areas provided by him.
- B. The Contractor shall hold the Owner harmless of any damages which might occur through the disposal of the waste and debris.
- C. Construction debris and all broken concrete, masonry, etc. shall be removed from the project as soon as possible.
- D. Where the Owner has granted permission to dispose of waste and debris within the project area, the Owner will have authority to establish whatever additional requirements that may be necessary to insure the satisfactory appearance of the area.

3.3 SEEDING AND MULCHING

- A. Seeding and mulching shall be performed in accordance with all applicable provisions of Section 1660 of the North Carolina State Department of Transportation's Standard Specifications for Roads and Structures, latest revision.
- B. Seeding and mulching shall be done on all earth areas disturbed by construction not destined for construction of structures or paving.

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- C. Apply mulch immediately after permanent seeding at a uniform rate sufficient to achieve approximately 80% coverage of ground surface. Care must be taken to prevent the mulch from being applied too thickly and smothering the seedlings. Mulch for temporary seeding should be applied based upon the recommendations of the Soil Conservation Service for the particular type of seed to be used.
- D. Denuded slopes must be seeded within 21 calendar days (10 calendar days within NCDOT right of way) following completion of any phase of development.

3.4 TEMPORARY SEEDING

- A. Temporary seeding shall be performed in accordance with the requirements of Section 01620 of the North Carolina State Department of Transportation's Standard Specifications for Roads and Structures, latest revisions and with Soil Conservation Service recommendations with regard to seed type, rate of application, fertilizer, etc.
- B. The kinds of seed and the rates of application of seed and fertilizer shall be as stated below.

1. Seeding Schedule

<u>Date</u>		
Apr 15 – Aug 14	German Millet	50 lbs./Acre
Aug 15 - Apr 14	Rye (Grain)	120 lbs./Acre

2. Year Round Fertilizer 10-10-10 Analysis 1000 lbs./acre

3.5 TEMPORARY MULCHING

- A. Temporary mulch may be used for the prevention of excessive soil erosion during construction operations where it is impossible or impractical to perform permanent seeding and mulching.
- B. Temporary much shall be placed promptly at the location and times directed by the Engineer.
- C. The temporary mulch may be required on previously seeded areas or on areas which have not been seeded.
- D. Temporary mulches may be straw, fiber mats, netting or other suitable material acceptable to the Engineer and shall be reasonably clean and free of noxious weeds and deleterious material. Mulch shall be spread uniformly over the area by hand or by means of approximate mechanical spreaders or blowers to obtain an application satisfactory to the Engineer. On seeded areas, satisfactory application of temporary mulch shall allow some sunlight to penetrate and air to circulate, but also partially shade the ground, reduce erosion and conserve soil moisture.
- E. When temporary mulching is being performed in connection with temporary seeding, no seeded areas shall be allowed to remain more than 24 hours without mulching having been completed.
- F. If seeding has been performed previously, care shall be exercised to prevent displacement of soil or seed, or other damage to the seeded area during temporary mulching operations.
- G. The Contractor shall take sufficient precautions to prevent temporary mulch from entering pipe lines and drainage structures through displacement by wind, water or other causes.

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- H. The Contractor shall apply a sufficient amount of asphalt or other type material to assure that the temporary mulch is properly held in place.
- I. In the application of asphalt materials during temporary mulching operations, adequate precautions shall be taken to prevent damage to traffic; and to any private or public property. Such property shall be adequately covered, or application methods changed, so as to avoid damage. Where any damage occurs as a result of the Contractor's failure to take adequate precautions, the Contractor will be required to repair such damage, including any cleaning that may be necessary, before final acceptance of the work will be made.

3.6 REPAIR SEEDING & MAINTENANCE

- A. Maintain the grass on the areas for a period of 90 days after the grass growth appears. Reseed bare areas and repair all eroded areas during that period.
- B. Inspect all seeded areas and make necessary repairs or reseedings within the planting season, if possible. If stand should be over 60% damaged, reestablish following original lime, fertilizer and seeding recommendations.
- C. All areas which do not exhibit satisfactory ground cover within 45 days of seed application shall be replanted.
- D. Repair seeding shall be performed in accordance with the requirements of Section 1661 of the North Carolina State Department of Transportation's Standard Specifications for Roads and Structures, latest revision.
- E. The kinds of seed and fertilizer shall be the same as specified for permanent "seeding and mulching". The rates of application of the various kinds of seed specified for "seeding and mulching" may vary as directed by the Engineer, however the total rate shall be substantially the same as for "seeding and mulching", but in no case will the total rate of seed and fertilizer vary more or less than twenty-five (25%) percent of that specified for "seeding and mulching".

3.7 SUPPLEMENTAL SEEDING

- A. The work covered by this section consists of the application of additional seed to an area already seeded with permanent seed but on which there is not a satisfactory cover of grass.
- B. The work of supplemental seeding does not include seedbed preparation, fertilizer, limestone, or mulch, and is intended only to provide an additional amount of seed to the Fertilizer Top dressing operation on projects that do not have a stand of grass thick enough to cover the ground in a reasonable length of time. This work does not conflict with nor replace repair seeding as its purpose is entirely different.
- C. The kinds of seed shall be the same as for "seeding and mulching", and the rate of application may vary from 25 pounds to 75 pounds per acre. The final rate per acre; if needed, will be determined by the Engineer prior to the time of top dressing and the Contractor will be notified in writing of the rate per acre, total quantity needed and areas on which to apply the supplemental seed.

3.8 FERTILIZER TOP DRESSING:

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- A. Fertilizer top dressing shall be performed in accordance with the requirements of Section 1665 of the North Carolina State Department of Transportation's Standard Specifications for Roads and Structures, latest revision.

END OF SECTION 02228

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SECTION 02230 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Removal of trees and other vegetation.
 2. Stripping and stockpiling topsoil.

1.2 PROJECT CONDITIONS

- A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SITE CLEARING

- A. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.
- B. Refer to Section 2300 Part 3 for specific direction as to when clearing on portions of the site may commence.
- C. Topsoil: Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.
1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.
 2. Stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion.
 3. Dispose of unsuitable or excess topsoil as specified for disposal of waste material.
- D. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.
1. Completely remove stumps, roots, and other debris protruding through ground surface.

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2. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 - a. Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact each layer to a density equal to adjacent original ground.

3.2 DISPOSAL OF WASTE MATERIALS

- A. Burning on Owner's Property: Burning is not permitted on Owner's property.
- B. Removal from Owner's Property: Remove waste materials and unsuitable or excess topsoil from Owner's property and dispose of at a permitted site.

END OF SECTION 02230

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SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
2. Excavating and backfilling for buildings and structures.
3. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

B. Related Sections include the following:

1. Division 2 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.

1.2 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Layer placed between the subgrade course and asphalt paving.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

E. Excavation: Removal of material encountered above subgrade elevations.

1. Additional Excavation: Excavation below subgrade elevations as directed by Engineer.
2. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
3. Bulk Excavation: Excavations more than 10 feet (3 m) in width and pits more than 30 feet (9 m) in either length or width.
4. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

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- H. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.
- I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of plastic warning tape.
 - 2. Drainage fabric.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill, backfill, and embankment fill.
 - 2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill, backfill, and embankment fill.

1.4 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.5 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Engineer's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

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- B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
- D. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- E. Backfill and Fill: Satisfactory soil materials.
- F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (38-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

2.2 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.
- B. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
 - 1. Grab Tensile Strength: 110 lbf (490 N); ASTM D 4632.
 - 2. Tear Strength: 40 lbf (178 N); ASTM D 4533.

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3. Puncture Resistance: 50 lbf (222 N); ASTM D 4833.
4. Water Flow Rate: 150 gpm per sq. ft. (100 L/s per sq. m); ASTM D 4491.
5. Apparent Opening Size: No. 50 (0.3 mm); ASTM D 4751.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 ENGINEERED FILL AND FOUNDATION SURCHARGE REQUIREMENTS

The following requirements apply to the work depicted on Sheet L2.1:

1. Establish drainage and erosion and sedimentation controls shown prior to earthwork operations.
2. Positive drainage shall be maintained on all building pad and pavement locations during the work. The Contractor shall not leave excavations, trenches, or pits open overnight. Slopes shall be maintained **daily** during the fill process in a manner that provides positive drainage of the filled surface and adjacent areas.
3. Protect bioretention facility from sedimentation with perimeter silt fence or other effective means. Sediment contaminated media shall be excavated, discarded and replaced as required to achieve required infiltration rate.

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3.4 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.5 EXCAVATION, GENERAL

- A. Unclassified Excavation: All excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.6 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures.
2. Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended for bearing surface.

3.7 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.8 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Excavate trenches to allow installation of top of pipe below frost line.

- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: As indicated.

- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

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3.9 APPROVAL OF SUBGRADE

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades. Contractor shall contact the Engineer 48 hours prior to performing proof roll to coordinate time.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer.

3.10 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Engineer.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

3.11 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for record documents.
 - 3. Inspecting and testing underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

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3.13 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings; fill with concrete to elevation of bottom of footings.
- C. Place and compact initial backfill of base material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit.
 - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
- D. Coordinate backfilling with utilities testing.
- E. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.
- F. Place and compact final backfill of satisfactory soil material to final subgrade.
- G. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.14 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.

3.15 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.16 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

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- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill material at 95 percent.
 - 2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 92 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 85 percent.
 - 4. Bioretention media and subgrade shall not be compacted. Mechanized equipment is prohibited from traversing the infiltration measure.

3.17 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1 inch (25 mm).
 - 2. Walks: Plus or minus 1 inch (25 mm).
 - 3. Pavements: Plus or minus 1/2 inch (13 mm).

3.18 BASE COURSES

- A. Under pavements, place base course on prepared subgrade and as follows:
 - 1. Place base course material over subgrade.
 - 2. Compact base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
 - 3. Shape base to required crown elevations and cross-slope grades.
 - 4. When thickness of compacted base course is 6 inches (150 mm) or less, place materials in a single layer.

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5. When thickness of compacted base course exceeds 6 inches (150 mm), place materials in equal layers, with no layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick when compacted.

B. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.

2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet (46 m) or less of trench length, but no fewer than two tests.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

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1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02300

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SECTION 02361 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Soil treatment with termiticide.
- B. See Division 6 Section "Rough Carpentry" for wood preservative treatment by pressure process.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include the EPA-Registered Label.
- B. Product certificates.
- C. Soil Treatment Application Report: Include the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Brand name and manufacturer of termiticide.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes, and rates of application used.
 - 6. Areas of application.
 - 7. Water source for application.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
- B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
 - 1. Warranty Period: Five years from date of Substantial Completion.

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1.5 MAINTENANCE SERVICE

- A. Continuing Service: Beginning at Substantial Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, and terms for agreement period; and terms for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Termiticides:
 - a. Aventis Environmental Science USA LP; Termidor.
 - b. Bayer Corporation; Premise 75.
 - c. Dow AgroSciences LLC; Dursban TC.
 - d. FMC Corporation, Agricultural Products Group; Talstar.
 - e. Syngenta; Demon TC.

2.2 SOIL TREATMENT

- A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
1. per 20 linear feet (6.1 linear meters), consisting of not less than 3 stations per cluster.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

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3.2 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
 3. Crawlspace: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
 4. Masonry: Treat voids.
 5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 02361

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SECTION 02751 - CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Curbs and gutters, valley gutters, and sidewalk.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork" for subgrade preparation, grading, and subbase course.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.3 SUBMITTALS

- A. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- B. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
 - 1. Cementitious materials and aggregates.
 - 2. Admixtures.
 - 3. Curing compounds.
 - 4. Applied finish materials.
 - 5. Bonding agent or adhesive.
 - 6. Joint fillers.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.

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- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.
- E. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

1.5 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 – PRODUCTS

2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves of a radius 100 feet (30.5 m) or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 CONCRETE MATERIALS

- A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.
- B. Portland Cement: ASTM C 150, Type I or II.
 - 1. Fly Ash: ASTM C 618, Class F or C.
 - 2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as follows:
 - 1. Class: 4S.
 - 2. Maximum Aggregate Size: 3/4 inch (19 mm) nominal.
 - 3. Do not use fine or coarse aggregates containing substances that cause spalling.

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- D. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.
- E. Air-Entraining Admixture: ASTM C 260.
- F. Water-Reducing Admixture: ASTM C 494, Type A.
- G. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- H. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- I. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.3 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- E. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- G. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.
- H. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- I. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Evaporation Retarder:
 - a. Cimfilm; Axim Concrete Technologies.
 - b. Finishing Aid Concentrate; Burke Group, LLC (The).
 - c. Spray-Film; ChemMasters.
 - d. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
 - e. Sure Film; Dayton Superior Corporation.
 - f. Eucobar; Euclid Chemical Co.
 - g. Vapor Aid; Kaufman Products, Inc.
 - h. Lambco Skin; Lambert Corporation.
 - i. E-Con; L&M Construction Chemicals, Inc.
 - j. Confilm; Master Builders, Inc.
 - k. Waterhold; Metalcrete Industries.
 - l. Rich Film; Richmond Screw Anchor Co.
 - m. SikaFilm; Sika Corporation.

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- n. Finishing Aid; Symons Corporation.
 - o. Certi-Vex EnvioAssist; Vexcon Chemicals, Inc.
2. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound:
- a. AH Curing Compound #2 DR; Anti-Hydro International, Inc.
 - b. Res-X Cure All Resin; Burke Group, LLC (The).
 - c. RX Cure; Conspec Marketing & Manufacturing Co., Inc.
 - d. Day-Chem Rez Cure; Dayton Superior Corporation.
 - e. Kurez DR; Euclid Chemical Co.
 - f. Nitocure S; Fosroc.
 - g. #64 Resin Cure; Lambert Corporation.
 - h. L&M Cure DR; L&M Construction Chemicals, Inc.
 - i. 3100-Clear; W. R. Meadows, Inc.
 - j. Seal N Kure FDR; Metalcrete Industries.
 - k. Rich Cure; Richmond Screw Anchor Co.
 - l. Resi-Chem C309; Symons Corporation.
 - m. Horncure 30; Tamms Industries Co., Div. of LaPorte Construction Chemicals North America, Inc.
 - n. Uni Res 150; Unitex.
 - o. Certi-Vex RC; Vexcon Chemicals, Inc.
3. Clear Waterborne Membrane-Forming Curing Compound:
- a. AH Curing Compound #2 DR WB; Anti-Hydro International, Inc.
 - b. Aqua Resin Cure; Burke Group, LLC (The).
 - c. Safe-Cure Clear; ChemMasters.
 - d. W.B. Resin Cure; Conspec Marketing & Manufacturing Co., Inc.
 - e. Day Chem Rez Cure (J-11-W); Dayton Superior Corporation.
 - f. Nitocure S; Fosroc.
 - g. Aqua Kure-Clear; Lambert Corporation.
 - h. L&M Cure R; L&M Construction Chemicals, Inc.
 - i. 1100 Clear; W. R. Meadows, Inc.
 - j. Resin Cure E; Nox-Crete Products Group, Kinsman Corporation.
 - k. Rich Cure E; Richmond Screw Anchor Co.
 - l. Resi-Chem Clear Cure; Symons Corporation.
 - m. Horncure 100; Tamms Industries Co., Div. of LaPorte Construction Chemicals North America, Inc.
 - n. Hydro Cure; Unitex.
 - o. Certi-Vex Enviocure; Vexcon Chemicals, Inc.
4. White Waterborne Membrane-Forming Curing Compound:
- a. AH Curing Compound #2 WB WP; Anti-Hydro International, Inc.
 - b. Aqua Resin Cure; Burke Group, LLC (The).
 - c. W.B. Resin Cure; Conspec Marketing & Manufacturing Co., Inc.
 - d. Thinfilm 450; Kaufman Products, Inc.
 - e. Aqua Kure-White; Lambert Corporation.
 - f. L&M Cure R-2; L&M Construction Chemicals, Inc.
 - g. 1200-White; W. R. Meadows, Inc.
 - h. White Pigmented Resin Cure E; Nox-Crete Products Group, Kinsman Corporation.
 - i. Rich Cure White E; Richmond Screw Anchor Co.

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- j. Resi-Chem High Cure; Symons Corporation.
- k. Horncure 200-W; Tamms Industries Co., Div. of LaPorte Construction Chemicals North America, Inc.
- l. Hydro White 309; Unitex.

2.4 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
 - 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
 - 2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
 - 3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.5 CONCRETE MIXES

- A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
 - 1. Do not use Owner's field quality-control testing agency as the independent testing agency.
- C. Proportion mixes to provide concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4500 psi (30.0 MPa) unless otherwise noted on plans.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.4-0.5.
 - 3. Slump Limit: 3-4 inches (75 mm).
 - a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches (200 mm) after adding admixture to plant- or site-verified, 2- to 3-inch (50- to 75-mm) slump.
- D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.

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- E. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2.5 to 4.5 percent.

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.
 - 1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.
- B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRICTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.3 JOINTS

- A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
 - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
- C. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

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1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 - a. Radius: 1/4 inch (6 mm).
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
- D. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
1. Radius: 1/4 inch (6 mm).
 2. Radius: 3/8 inch (10 mm).

3.4 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subgrade surface before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subgrade to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery, at Project site, or during placement.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- H. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess

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moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.

- I. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
- J. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- K. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- L. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.5 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
 - 2. Alternating broom finish at main entrance and healing garden #3, as shown on Landscape Architecture Plans.

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3.6 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.7 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 - 1. Elevation: 1/4 inch (6 mm).
 - 2. Thickness: Plus 3/8 inch (9 mm), minus 1/4 inch (6 mm).
 - 3. Surface: Gap below 10-foot- (3-m-) long, unlevelled straightedge not to exceed 1/4 inch (6 mm).
 - 4. Joint Spacing: 3 inches (75 mm).
 - 5. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
 - 6. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.8 FIELD QUALITY CONTROL

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- A. Testing Agency: Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- C. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.9 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.
- B. Drill test cores where directed by Engineer when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 02751

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SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes cast-in-place concrete, including reinforcement, concrete materials, mix design, placement procedures, and finishes.
- B. See Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.

1.2 SUBMITTALS

- A. Product Data: For each manufactured material and product indicated.
- B. Design Mixes: For each concrete mix indicated.
- C. Shop Drawings: Include details of steel reinforcement placement including material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports.
- D. Material certificates test reports.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- B. Comply with ACI 301, "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents.
 - 1. General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
 - 2. Formwork and form accessories.
 - 3. Steel reinforcement and supports.
 - 4. Concrete mixtures.
 - 5. Handling, placing, and constructing concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Formwork: Furnish formwork and form accessories according to ACI 301.
- B. Steel Reinforcement:
 - 1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
 - 2. Plain-Steel Wire: ASTM A 82, as drawn.

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3. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- C. Concrete Materials:
1. Portland Cement: ASTM C 150, Type I
 2. Normal-Weight Aggregate: ASTM C 33, uniformly graded, not exceeding 3/4-inch nominal size.
 3. Water: Complying with ASTM C 94.
- D. Admixtures:
1. Air-Entraining Admixture: ASTM C 260.
 2. Water-Reducing Admixture: ASTM C 494, Type A.
 3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
 5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
- E. Vapor Retarder: Multi-ply reinforced polyethylene sheet, ASTM E 1745, Class C, not less than 7.8 mils thick; or polyethylene sheet, ASTM D 4397, not less than 10 mils thick.
- F. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- G. Curing Materials:
1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf.
 3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
 4. Water: Potable.
 5. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.2 CONCRETE MIXES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.

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1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete and concrete with a water-cementitious materials ratio below 0.50.

E. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.55.
3. Slump Limit: 4 inches plus or minus 1 inch at point of delivery (prior to pumping).
4. Slump Limit for concrete containing high-range water-reducing admixture or plasticizing admixture: 8 inches maximum for concrete with approved design mix slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture.
5. Air Content: 2 percent, plus or minus 1.5 percent at point of delivery (prior to pumping).

F. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 4 inches plus or minus 1 inch at point of delivery (prior to pumping).
4. Slump Limit for concrete containing high-range water-reducing admixture or plasticizing admixture: 8 inches maximum for concrete with approved design mix slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture.
5. Air Content: 2 percent, plus or minus 1.5 percent at point of delivery (prior to pumping).
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent at point of delivery (prior to pumping).

2.3 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with ASTM C 94.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Formwork: Design, construct, erect, shore, brace, and maintain formwork according to ACI 301.

B. Vapor Retarder: Install, protect, and repair vapor-retarder sheets according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

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2. Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
- C. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- D. Joints: Construct joints true to line with faces perpendicular to surface plane of concrete.
1. Construction Joints: Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Architect.
 2. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - a. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 3. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
 - a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 - b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- E. Tolerances: Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3.2 CONCRETE PLACEMENT

- A. Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.
- B. Do not add water to concrete during delivery, at Project site, or during placement.
- C. Consolidate concrete with mechanical vibrating equipment.

3.3 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
 1. Apply to concrete surfaces not exposed to public view.

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- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Completely remove fins and other projections.
 - 1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 - 2. Do not apply rubbed finish to smooth-formed finish.
 - 3. Apply smooth-rubbed finish, defined in ACI 301, to smooth-formed finished concrete.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.4 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.
 - 1. Do not further disturb surfaces before starting finishing operations.
- C. Scratch Finish: Apply scratch finish to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finish, unless otherwise indicated.
- D. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- E. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.
- F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- G. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.5 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection, and follow recommendations in ACI 305R for hot-weather protection during curing.

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- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions occur before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Cure formed and unformed concrete for at least seven days as follows:
 - 1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Tests will be performed according to ACI 301.
 - 1. Testing Frequency: One composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

END OF SECTION 03300

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SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
 - 1. Concrete masonry units (CMUs).
 - 2. Face brick.
- B. See Division 5 Section "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
- C. See Division 7 Section "Sheet Metal Flashing and Trim" for furnishing manufactured reglets installed in masonry joints for metal flashing.
- D. Allowances: The following are included under the allowances indicated as specified in Division 1 Section "Allowances":
 - 1. Face brick under the Face Brick Allowances.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for each type and color of exposed masonry units and colored mortars.
- C. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.
 - 1. For masonry units include material test reports substantiating compliance with requirements.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1.3 QUALITY ASSURANCE

- A. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects.
 - 1. Build sample panels for typical exterior wall in sizes approximately **48 inches (1200 mm)** long by **48 inches (1200 mm)** high.

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1.4 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 COLORS, TEXTURES, AND PATTERNS

- A. Exposed Masonry Units: Match sample.

2.3 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- B. Concrete Masonry Units: ASTM C 90. Normal weight block.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **1900 psi (13.1 MPa)**.

2.4 BRICK

- A. General: Provide shapes indicated and as follows:
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face Brick: ASTM C 216, Grade MW, Type FBX.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **3000 psi (20.7 MPa)**.

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2. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
4. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
5. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long.

2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Masonry Cement: ASTM C 91.
- D. Mortar Pigments: Iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
- E. Aggregate for Mortar: ASTM C 144.
 1. For joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
 2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- F. Aggregate for Grout: ASTM C 404.
- G. Water: Potable.

2.6 TIES AND ANCHORS

- A. Materials:
 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.
- C. Adjustable Masonry-Veneer Anchors
 1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

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- a. Structural Performance Characteristics: Capable of withstanding a 100-lbf (445-N) load in both tension and compression without deforming or developing play in excess of 0.05 inch (1.3 mm).
2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - a. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.

2.7 EMBEDDED FLASHING MATERIALS

- A. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:
 1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch (1.0 mm).
 - a. Products:
 - 1) Advanced Building Products Inc.; Peel-N-Seal.
 - 2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
 - 3) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier-44.
 - 4) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
 - 5) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
 - 6) Hohmann & Barnard, Inc.; Textroflash.
 - 7) Polyguard Products, Inc.; Polyguard 300.
 - 8) Polytite Manufacturing Corp.; Poly-Barrier Self-Adhering Wall Flashing.
 - 9) Williams Products, Inc.; Everlastic MF-40.
- B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Weep/Vent Products: Use one of the following, unless otherwise indicated:
 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Products:
 - 1) Advanced Building Products Inc.; Mortar Maze weep vent.
 - 2) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
 - 3) Heckmann Building Products Inc.; No. 85 Cell Vent.
 - 4) Hohmann & Barnard, Inc.; Quadro-Vent.
 - 5) Wire-Bond; Cell Vent.

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2.9 INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, closed-cell product extruded with an integral skin.

2.10 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains from new masonry without damaging masonry. Use product approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

- 1. Manufacturers:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.11 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Limit cementitious materials in mortar for exterior masonry to portland cement and lime.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification.
 - 1. For masonry below grade or in contact with earth, use Type M.
 - 2. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
- C. Pigmented Mortar: Use colored cement product.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
- C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

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- D. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than **1/8 inch in 10 feet (3 mm in 3 m)**, **1/4 inch in 20 feet (6 mm in 6 m)**, or **1/2 inch (12 mm)** maximum.
 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than **1/8 inch in 10 feet (3 mm in 3 m)**, **1/4 inch in 20 feet (6 mm in 6 m)**, or **1/2 inch (12 mm)** maximum.

3.2 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal **4-inch (100-mm)** horizontal face dimensions at corners or jambs.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

3.3 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and concrete masonry units as follows:
1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.

3.4 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
1. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

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- C. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately **12 inches (300 mm)** o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit insulation between wall ties and other confining obstructions, with edges butted tightly. Press units firmly against inside wythe of masonry.

3.5 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners.
 - 2. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 3. Space anchors as indicated, but not more than **16 inches (406 mm)** o.c. vertically and **24 inches (610 mm)** o.c. horizontally with not less than 1 anchor for each **2.67 sq. ft. (0.25 sq. m)** of wall area. Install additional anchors within **12 inches (305 mm)** of openings and at intervals, not exceeding **36 inches (914 mm)**, around perimeter.

3.6 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows, unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing as recommended by flashing manufacturer.
 - 2. At lintels and shelf angles, extend flashing a minimum of **6 inches (150 mm)** into masonry at each end. At heads and sills, extend flashing **6 inches (150 mm)** at ends and turn up not less than **2 inches (50 mm)** to form end dams.
- C. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.

3.7 CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 - 2. Protect adjacent surfaces from contact with cleaner.
 - 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

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5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.8 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 1. Do not dispose of masonry waste as fill within **18 inches (450 mm)** of finished grade.
 2. Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04810

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SECTION 05120 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Structural steel.
 - 2. Grout.
- B. Related Sections include the following:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads and all other miscellaneous steel indicated on the structural drawings.

1.4 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand service loads indicated and comply with other information and restrictions indicated.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

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- C. Welding certificates.
- D. Qualification Data: For fabricator.
- E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who can demonstrate a minimum of 5 years of continuous experience with projects of equal size and complexity. Detailed list of projects justifying this requirement will be submitted if requested.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Std.
- D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel."
- E. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC's "Seismic Provisions for Structural Steel Buildings."
 - 3. AISC's "Specification for Structural Steel Buildings."
 - 4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
 - 5. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

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1.8 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992.
- B. Channels, Angles: ASTM A 36.
- C. Plate and Bar: ASTM A 36.
- D. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- B. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A 563 heavy hex carbon steel.
 - 3. Plate Washers: ASTM A 36 carbon steel.
 - 4. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
 - 5. Finish: Plain or hot-dip zinc coating, ASTM A 153, Class C as indicated.

2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings."
 - 1. Camber structural-steel members where indicated.

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2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
 3. Mark and match-mark materials for field assembly.
 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning and SSPC-SP 3, "Power Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.

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2. Surfaces to be field welded.
 3. Surfaces to be high-strength bolted with slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials.
 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 2, "Hand Tool Cleaning."
 2. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.8 SOURCE QUALITY CONTROL

- A. Engage a testing agency to perform shop tests and inspections and prepare test reports. Submit all test and inspection reports at conclusion of fabrication and prior to shipping steel.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Welded Connections: In addition to visual inspection, all full penetration shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
1. Liquid Penetrant Inspection: ASTM E 165.
 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings."
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate as indicated.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout. Pre-tension anchor bolts where indicated.
 - 4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.

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- F. Remove erection bolts on welded, exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.5 REPAIRS AND PROTECTION

- A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted steel.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 05120

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SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Framing with dimension lumber.
 - 2. Framing with engineered wood products.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Wood blocking, cants, and nailers.
 - 5. Wood furring and grounds.
 - 6. Wood sleepers.
 - 7. Plywood backing panels.

1.2 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
 - 1. Include data for wood-preserved treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

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2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWPA C2[, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWWPA C31 with inorganic boron (SBX)].
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

- A. Maximum Moisture Content: 19 percent
- B. Non-Load-Bearing or Non-Shear wall Interior Partitions: Construction or No. 2 grade of any species.
- C. Framing Other Than Non-Load-Bearing or Non-Shear wall Interior Partitions: No. 2 grade and any of the following species:
 - 1. Southern pine; SPIB.
 - 2. Mixed southern pine; SPIB.

2.4 ENGINEERED WOOD PRODUCTS

- A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559 and containing no urea formaldehyde.

2.5 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.

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4. Cants.
5. Furring.
6. Grounds.

- B. For blocking and nailers, provide No. 2 grade Southern pine or Mixed Southern pine.
- C. For items of dimension lumber size other than blocking and nailers, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.
- D. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
1. Mixed southern pine, No. 2 grade; SPIB.
 2. Eastern softwoods, No. 2 Common grade; NeLMA.
 3. Northern species, No. 2 Common grade; NLGA.
 4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

2.6 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exterior, AC in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fastener with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Power-Driven Fasteners: NES NER-272.
- C. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- D. Screws for fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

2.8 METAL FRAMING ANCHORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preserved-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- E. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- F. Do not splice structural members between supports, unless otherwise indicated.
- G. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
 - 4. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
 - 5. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
 - 6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06100

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SECTION 06160 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing.
 - 2. Roof sheathing.
 - 3. Sheathing joint and penetration treatment.
- B. Related Requirements:
 - 1. **[Section 061000 "Rough Carpentry"]** for plywood backing panels.
 - 2. Section 07275 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - 3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For following products, from ICC-ES:
 - 1. Preservative-treated plywood.

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1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations from [UL's "Fire Resistance Directory."] [GA-600, "Fire Resistance Design Manual."] <Insert listing organization and publication>.

2.2 WOOD PANEL PRODUCTS

- A. Emissions: Products shall meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Certified Wood: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
 - 1. Plywood.
 - 2. Oriented strand board.
 - 3. Fiberboard wall sheathing.
 - 4. Particleboard underlayment.
 - 5. Hardboard underlayment.
- C. Plywood: **DOC PS 1 unless otherwise indicated**].
- D. Oriented Strand Board: DOC PS 2.
- E. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- F. Factory mark panels to indicate compliance with applicable standard.

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2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2[for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground].
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: **Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.**

2.4 WALL SHEATHING

- A. Plywood Wall Sheathing: [**Exterior, Structural I**] or [**Exposure 1, Structural I**] sheathing.
 - 1. Span Rating: Not less than [**16/0**]
 - 2. Nominal Thickness: Not less than [**1/2 inch (13 mm)**].
- B. Oriented-Strand-Board Wall Sheathing: [**Exposure 1, Structural I**] sheathing.
 - 1. Span Rating: Not less than [**16/0**]
 - 2. Nominal Thickness: Not less than [**1/2 inch (13 mm)**].
- C. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.
 - 1. **Manufacturers:** Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - a. [American Gypsum.](#)
 - b. [G-P Gypsum Corporation.](#)
 - c. [LaFarge North America Inc.](#)
 - d. [National Gypsum Company.](#)
 - e. [Temple-Inland Inc.](#)
 - f. [United States Gypsum Co.](#)
 - g. **<Insert manufacturer's name>.**
 - 2. Type and Thickness: [**Regular, 5/8 inch (16 mm)**]
 - 3. Size: [**48 by 96 inches (1219 by 2438 mm) for vertical**] installation.

2.5 ROOF SHEATHING

- A. Plywood Roof Sheathing: **Exterior, Structural I** sheathing.

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1. Span Rating: Not less than **24/0**.
 2. Nominal Thickness: Not less than [**15/32 inch (11.9 mm)**].
- B. Oriented-Strand-Board Roof Sheathing: Exterior **Structural I** sheathing.
1. Span Rating: Not less than [**24/0**].
 2. Nominal Thickness: Not less than **15/32 inch (11.9 mm)**

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. For roof **and wall** sheathing, provide fasteners [**with hot-dip zinc coating complying with ASTM A 153/A 153M**
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
- F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
1. For steel framing less than **0.0329 inch (0.835 mm)** thick, use screws that comply with ASTM C 1002.
 2. For steel framing from **0.033 to 0.112 inch (0.84 to 2.84 mm)** thick, use screws that comply with ASTM C 954.
- G. Screws for Fastening Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

2.7 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

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1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.
- B. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 1. NES NER-272 for power-driven fasteners.
 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate [wall] [and] [roof] sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 1. Wall and Roof Sheathing:

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- a. **[Nail]** to wood framing
- b. Screw to cold-formed metal framing.
- c. Space panels **1/8 inch (3 mm)** apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
1. Fasten gypsum sheathing to wood framing with **[nails] [or] [screws]**.
 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 3. Install boards with a **3/8-inch (9.5-mm)** gap where non-load-bearing construction abuts structural elements.
 4. Install boards with a **1/4-inch (6.4-mm)** gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
1. Space fasteners approximately **8 inches (200 mm)** o.c. and set back a minimum of **3/8 inch (9.5 mm)** from edges and ends of boards.
 2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
1. Space fasteners approximately **8 inches (200 mm)** o.c. and set back a minimum of **3/8 inch (9.5 mm)** from edges and ends of boards.
 2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06160

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SECTION 06176 - METAL-PLATE-CONNECTED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Wood roof trusses.
2. Wood truss bracing.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1.

1.3 SUBMITTALS

A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.

B. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
5. Show splice details and bearing details.
6. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

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- C. Comply with applicable requirements and recommendations of the following publications:
 - 1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
 - 2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
 - 3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."
- E. Forest Certification: Provide metal-plate-connected wood trusses produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

PART 2 - PRODUCTS

2.1 DIMENSION LUMBER

- A. Lumber: DOC PS 20. Provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Grade and Species: For truss chord and web members, provide dimension lumber of any species, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."
- C. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Division 6 Section Miscellaneous Carpentry.

2.2 METAL PRODUCTS

- A. Connector Plates: Fabricate connector plates to comply with TPI 1 from hot-dip galvanized steel sheet complying with ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); **G60 (Z180)** coating designation; and not less than **0.036 inch (0.9 mm)** thick.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Alpine Engineered Products, Inc.
 - b. Cherokee Metal Products, Inc.; Masengill Machinery Company.
 - c. CompuTrus, Inc.
 - d. Eagle Metal Products.
 - e. Jager Building Systems, Inc.
 - f. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.
 - g. Robbins Engineering, Inc.

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- h. TEE-LOK Corporation; a subsidiary of Berkshire Hathaway Inc.
 - i. Truswal Systems Corporation.
- B. Fasteners: Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- 1. Nails, Brads, and Staples: ASTM F 1667.
 - 2. Power-Driven Fasteners: NES NER-272.
 - 3. Wood Screws: ASME B18.6.1.
 - 4. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
 - 5. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.
- C. Metal Truss Accessories: Provide truss accessories made from hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Drawings or comparable products by one of the following:
 - a. Cleveland Steel Specialty Co.
 - b. Harlen Metal Products, Inc.
 - c. KC Metals Products, Inc.
 - d. Simpson Strong-Tie Co., Inc.
 - e. Southeastern Metals Manufacturing Co., Inc.
 - f. USP Structural Connectors.
 - g. Other approved manufacturer.
 - 4. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.3 FABRICATION

- A. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- B. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in truss accessories according to manufacturer's fastening schedules and written instructions.
- F. Securely connect each truss ply required for forming built-up girder trusses.
- G. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Division 6 Section Miscellaneous Carpentry.
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- H. Install wood trusses within installation tolerances in TPI 1.
- I. Do not cut or remove truss members.
- J. Replace wood trusses that are damaged or do not meet requirements.

END OF SECTION 06176

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SECTION 07210 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Cavity-wall insulation.
 - 2. Concealed building insulation.
 - 3. Vapor retarders.
 - 4. Sound attenuation insulation.

1.2 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
 - 1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at **2500-fpm (13-m/s)** air velocity.
 - 2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with *Chaetomium globosum* on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product test reports.
- C. Research/Evaluation Reports: For foam-plastic insulation.

1.4 QUALITY ASSURANCE

- A. Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84 for surface-burning characteristics and other methods indicated with product, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60 lb/cu. ft. (26 kg/cu. m), with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:
1. Available Manufacturers:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company.
 - c. Owens Corning.
 - d. Pactiv Building Products Division.

2.3 GLASS-FIBER BLANKET INSULATION

- A. Available Manufacturers:
1. CertainTeed Corporation.
 2. Guardian Fiberglass, Inc.
 3. Johns Manville.
 4. Knauf Fiber Glass.
 5. Owens Corning.
- A. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. – Use where insulation is separated from interior spaces by gypsum board.
- B. Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene. – Use where insulation is exposed to interior spaces , including above ceiling spaces.

2.4 WEATHER BARRIER

- A. Basis of Design: High-performance, spunbonded polyolefin, non-woven, non-perforated, weather barrier is based upon DuPont™ Tyvek® CommercialWrap® and related assembly components.
- B. Performance Characteristics:
1. Air Penetration: 0.001 cfm/ft² at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677.

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2. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
3. Water Penetration Resistance: 280 cm when tested in accordance with AATCC Test Method 127.
4. Basis Weight: 2.7 oz/yd², when tested in accordance with TAPPI Test Method T-410.
5. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
6. Tensile Strength: 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
7. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.

8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E 84. Flame Spread: 10, Smoke Developed: 10.

2.5 AUXILIARY INSULATING MATERIALS

- A. Weather Barrier Tape: Pressure-sensitive tape of type recommended by membrane manufacturers for sealing joints and penetrations in weather barrier.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

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3.2 INSTALLATION OF PERIMETER INSULATION

- A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
- B. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.

3.3 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Install weather barrier in accordance with barrier manufacturer's written requirements

3.4 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Install 3-1/2-inch- (38-mm-) thick, unfaced glass-fiber blanket insulation over suspended ceilings so that insulation extends over entire ceiling.

END OF SECTION 07210

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SECTION 07275 - WEATHER BARRIERS

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. Section Includes:
 - 1. Building wrap.
- B. Related Requirements:
 - 1. Division 6 Section "Sheathing" for sheathing joint and penetration treatment..

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

- A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than **0.030 inch (0.8 mm)**.
 - 1. Products: Subject to compliance with requirements, provide product equal to the following:
 - a. DuPont (E. I. du Pont de Nemours and Company); DuPont Flashing Tape.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Butyl Self Adhered Flashing.
- B. Nails and Staples: ASTM F 1667.

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PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
 - 1. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap unless otherwise indicated.
- C. Building Wrap: Comply with manufacturer's written instructions.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
 - 1. Prime substrates as recommended by flashing manufacturer.
 - 2. Lap seams and junctures with other materials at least 4 inches (100 mm) except that at flashing flanges of other construction, laps need not exceed flange width.
 - 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 - 4. Lap water-resistive barrier over flashing at heads of openings.
 - 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 07275

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SECTION 07311 - ASPHALT SHINGLES

GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Asphalt shingles.
 - 2. Underlayment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each exposed product and for each color and blend specified.
- C. Product test reports.
- D. Research/evaluation reports.
- E. Maintenance data.
- F. Warranties: Sample of special warranties.

1.3 WARRANTY

- A. Special Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period.
 - 1. Material Warranty Period: 30 years from date of Substantial Completion, prorated, with first 12 years nonprorated.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Laminated-Strip Asphalt Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product equal to the following:
 - a. Duration – By Owens Corning
 - 2. Butt Edge: Straight cut.
 - 3. Strip Size: Manufacturer's standard.
 - 4. Algae Resistance: Granules treated to resist algae discoloration.
 - 5. Color and Blends: As selected by Architect from manufacturer's full range.
- B. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

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2.2 UNDERLAYMENT MATERIALS

- A. Self-Adhering Sheet Membrane Roof Underlayment with the following characteristics:
1. Material: Cold applied, self- adhering membrane composed of a high strength polyethylene film coated on one side with a layer of rubberized asphalt adhesive 3
 2. Membrane Thickness: 40 mil (1.02 mm) ASTM D3767 procedure A (Section 9.1).
 3. Tensile Strength, Membrane: 250 psi (1720 kN/m²) ASTM D412 (Die C modified).
 4. Elongation, Membrane: 250% ASTM D412 (Die C modified).
 5. Low Temperature Flexibility: Unaffected @ -20°F (-29°C) ASTM D1970.
 6. Adhesion to Plywood: 3.0 lbs/in. width (525 N/m) ASTM D903.
 7. Permeance (Max): 0.05 perms (2.9 ng/m²s Pa) ASTM E96.
 8. Material Weight Installed (Max): 0.3 lb/ft² (1.3 kg/m²) ASTM D461.
 9. Primer: Water-based Perm-A-Barrier WB Primer by GCP Applied Technologies, Inc.
- B. Basis of Design
- Ice and water shield
- Manufacturer: GCP Applied Technologies, Inc, 62 Whittemore Avenue, Cambridge, MA 02140, Toll Free 866-333-3726, www.gcpat.com.

2.3 RIDGE VENTS

- A. Rigid Ridge Vent: Manufacturer's standard, rigid section high-density polypropylene or other UV-stabilized plastic ridge vent with nonwoven geotextile filter strips and external deflector baffles; for use under ridge shingles.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Air Vent, Inc.; a Gibraltar Industries company.
 - b. Cor-A-Vent, Inc.
 - c. GAF Materials Corporation.
 - d. Lomanco, Inc.
 - e. Mid-America Building Products.
 - f. Obdyke, Benjamin Incorporated.
 - g. Owens Corning.
 - h. RGM Products, Inc.
 - i. Trimline Building Products.

2.4 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum **0.120-inch- (3-mm-)** diameter, barbed shank, sharp-pointed, with a minimum **3/8-inch- (9.5-mm-)** diameter flat head and of sufficient length to penetrate **3/4 inch (19 mm)** into solid wood decking or extend at least **1/8 inch (3 mm)** through OSB or plywood sheathing.
1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.

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- C. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, **1-inch (25-mm)** minimum diameter.

2.5 METAL FLASHING AND TRIM

- A. General: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
 - 1. Sheet Metal: Copper.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
- B. Self adhering Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of **2 inches (50 mm)** over underlying course. Lap ends a minimum of **4 inches (100 mm)**. Stagger end laps between succeeding courses at least **72 inches (1830 mm)**.

3.2 METAL FLASHING INSTALLATION

- A. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
 - 1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

3.3 ASPHALT SHINGLE INSTALLATION

- A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip with tabs removed at least **7 inches (175 mm)** wide with self-sealing strip face up at roof edge.
 - 1. Extend asphalt shingles **1/2 inch (13 mm)** over fasciae at eaves and rakes.
 - 2. Install starter strip along rake edge.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Fasten asphalt shingle strips with a minimum of six roofing nails located according to manufacturer's written instructions.
 - 1. When ambient temperature during installation is below **50 deg F (10 deg C)**, seal asphalt shingles with asphalt roofing cement spots.

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- E. Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips. Maintain uniform width of exposed open valley from highest to lowest point.
- F. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- G. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
- H. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

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SECTION 07920 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
 - 1. Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
- B. See Division 2 Section "Pavement Joint Sealants" for sealing joints in pavements, walkways, and curbing.
- C. See Division 8 Section "Glazing" for glazing sealants.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

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- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Single-Component Nonsag Urethane Sealant:
 - 1. Available Products:
 - a. Sika Corporation, Inc.; Sikaflex - 1a.
 - b. Sonneborn, Division of ChemRex Inc.; Ultra.
 - c. Sonneborn, Division of ChemRex Inc.; NP 1.
 - d. Tremco; Vulkem 116.
 - 2. Type and Grade: S (single component) and NS (nonsag).
 - 3. Class: 25.
 - 4. Uses Related to Exposure: NT (nontraffic).

2.4 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

2.5 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.
 - a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove

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loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.

- B. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- C. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- D. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- E. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION 07920

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SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 08710 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 3. Locations of reinforcement and preparations for hardware.
 - 4. Details of anchorages, joints, field splices, and connections.
 - 5. Details of moldings, removable stops, and glazing.
 - 6. Details of conduit and preparations for power, signal, and control systems.
- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

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1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ceco Door Products; an Assa Abloy Group company.
 - 2. Curries Company; an Assa Abloy Group company.
 - 3. Republic Doors and Frames.
 - 4. Steelcraft; an Ingersoll-Rand company.
 - 5. The MPI Group, LLC.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At all locations unless otherwise indicated.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches (44.5 mm.)
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm), with minimum A40 (ZF120) coating.
 - d. Edge Construction: Model 1, Full Flush.

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- e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.6 when tested according to ASTM C 1363.
- 3. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
 - b. Construction: Full profile welded.
- 4. Exposed Finish: Prime.

2.3 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.4 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- E. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

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- F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- G. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 - 2. Fire Door Cores: As required to provide fire-protection ratings indicated.
 - 3. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
 - 4. Top Edge Closures: Close top edges of doors with **flush closures** of same material as face sheets.
 - 5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
 - 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
 - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
 - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.

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- 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.6 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.7 ACCESSORIES

- A. Grout Guards: Formed from same material as frames, not less than **0.016 inch (0.4 mm)** thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

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- B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install door silencers in frames before grouting.
 - c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - d. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - e. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
 - b. At Bottom of Door: 5/8 inch (15.8 mm) plus or minus 1/32 inch (0.8 mm).
 - c. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

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3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08110

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SECTION 08710 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Commercial door hardware.
 - 2. Cylinders for doors specified in other Sections.
 - 3. Hardware for controlled access doors
- B. See Division 8 door sections for astragals and door silencers.
- C. See section 01210 – Allowances -- The information that follows in this section is provided to allow pricing of submittals, handling, and installation labor associated with hardware that shall be included in base bid.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Details of electrified door hardware, including wiring diagrams.
- C. Samples: For each exposed finish.
- D. Other Action Submittals:
 - 1. Door Hardware Sets: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as procedures and diagrams.
 - a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - b. Content: Include the following information:
 - 1) Identification number, location, hand, fire rating, and material of each door and frame.
 - 2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
 - 3) Complete designations of every item required for each door or opening including name and manufacturer.
 - 4) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
 - 2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks.

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1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
 - 1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
- B. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
 - 1. Test Pressure: Test at atmospheric pressure.
- D. Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- B. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.5 COORDINATION

- A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Three years from date of Substantial Completion

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PART 2 - PRODUCTS

2.1 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference into grand master key system.
 - 1. Existing System: Master key or grand master key locks to Owner's existing system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Steel Doors and Frames: Comply with DHI A115 Series. Drill and tap doors and frames for surface-applied door hardware according to ANSI A250.6.
- B. Wood Doors: Comply with DHI A115-W Series.
- C. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point **3 inches (75 mm)** from the latch, measured to the leading edge of the door.

END OF SECTION 08710

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SECTION 09250 - GYPSUM BOARD

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. Section Includes:
 - 1. Interior gypsum board.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. CertainTeed Corp.
 - 2. Georgia-Pacific Gypsum LLC.
 - 3. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Long Edges: Tapered.
- C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Long Edges: Tapered.
- D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch (15.9 mm), Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.

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1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 1. Products: Subject to compliance with requirements, provide one of the following:

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- a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR
 - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Acoustical joint sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 2. Fit gypsum panels around ducts, pipes, and conduits.

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3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 1. Type X: Vertical surfaces unless otherwise indicated.
 2. Flexible Type: Apply in double layer at curved assemblies.
 3. Ceiling Type: Ceiling surfaces.
 4. Moisture- and Mold-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:

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1. Cornerbead: Use at outside corners.

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in other Division 9 Sections.

3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09250

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SECTION 09910 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

A. Work Included This Section:

1. Work of this Section shall consist of providing all painting, as indicated on Drawings and as specified.
2. Term "Paint" as used herein, includes emulsion, enamels, paints, varnishes, stains, oils, and other coatings used as prime, intermediate, or finish coats.

B. Related Work Specified Elsewhere:

1. Painting of Mechanical, Plumbing, and Electrical Work (Divisions 15 and 16).

C. Surfaces to be Painted:

1. Complete coverage of all exposed surfaces is intended. Without restricting the extent of the work to be performed, the work shall include, but is not limited to the following:
 - a) Structural Steel:
 - 1) Remove any rust and touch-up after erection.
 - b) Ferrous Metal:
 - 1) All exposed surfaces of all ferrous metal work, including galvanized, both exterior and interior of building, which is not finished painted under other Sections.
 - a) This includes all hollow metal work and metal louvers, gravel stops, exposed metal flashing, architectural (exposed) structural steel and decking, exterior handrails, and similar items.
 - c) Mechanical Grilles and Diffusers and Electrical Panels noted to be field-painted:
 - 1) Paint to match color of surface in which item is mounted.

D. Related Work Specified Elsewhere:

1. Shop coats on fabricated items.
2. Factory-applied finishes.

1.3 QUALITY ASSURANCE

A. Source:

1. Products for use on this Project shall be of one manufacturer unless noted specifically otherwise herein.

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1.4 SUBMITTALS

A. Product Data:

1. For each paint system indicated.
 - a) Include block fillers and primers.
2. Material List:
 - a) An inclusive list of required coating materials.
 - b) Indicate each material and cross-reference specific coating, finish system, and application.
 - c) Identify each material by manufacturer's catalog number and general classification.
3. Manufacturer's Information:
 - a) Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

1.5 PRODUCT HANDLING

A. Storage of Materials:

1. Paints, enamels, lacquers, sealers, stains, varnish, paste fillers and similar materials shall be delivered in original sealed containers that plainly show designated name, formulas, or specification number, batch number, color, date of manufacture, Manufacturer's directions, and name of Manufacturer.

- B. Store all materials in single, heated space. Keep storage place neat and clean, and remove soiled or used rags, waste and trash from building.

1.6 ENVIRONMENTAL CONDITIONS

- A. Exterior painting shall not be performed when the temperature is below 50 degrees F., while the surface is damp, during cold, rains, or frosty weather, or when temperature is likely to drop to freezing within 24 hours.

- B. Avoid painting surfaces while they are exposed to hot sun.

C. Cleaning Area:

1. Before painting is started in any area, it shall be broom cleaned and dust shall be removed from all areas to be painted.
2. After painting operations begin in a given area, room cleaning will not be allowed.
3. Cleaning thereafter shall be with commercial cleaning equipment.

1.7 PAINTING WORK

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

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B. Cleaning:

1. Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings.
2. Remove oil and grease before cleaning.
3. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation:

1. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
2. Provide barrier coats over incompatible primers or remove and reprime.

D. Prime Coats:

1. Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others.
2. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

E. Paint properly prepared surfaces.

1. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces.
2. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
3. Provide two coats of paint as specified on Drawings or herein.

1.8 PROTECTION

A. Drop Cloths:

1. Protect adjacent areas and installations by use of drop cloths or other approved precautionary measures.

B. Hardware and Fixtures:

1. Remove and protect hardware, accessories, device plates, lighting fixtures, factory finished work, and similar items; or provide ample in-place protection.
2. Upon completion of each space, carefully replace all removed items.
3. All painting work shall be done only by skilled mechanics, using adequate tools for work to be done.
4. Protect plumbing fixtures and trim.
5. Standing on fixtures shall be prohibited.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the specifications, provide products from one of the following:

1. Duro Paints/Duro, Inc. (Duro)
2. Devco Paints

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3. Sherwin-Williams
4. Benjamin Moore

2.2 PAINT MATERIALS

- A. Paint shall arrive at project site, ready-mixed, except for tinting of undercoats, and thinning, if directed by Manufacturer's printed instruction and allowed by the Architect.
- B. Tinting materials shall be as recommended by Manufacturer for particular materials to be tinted.

2.3 THINNER

- A. Type and product recommended by manufacturer of finishing material.
- B. Turpentine:
 1. Pure gum spirits of turpentine, ASTM Specification D 13.
- C. Mineral Spirits:
 1. ASTM Specification D13.

2.4 APPLICATION EQUIPMENT

- A. Equipment shall be adequate and in keeping with work and workmanship required herein.

PART 3 - EXECUTION

3.1 INSPECTION OF SURFACES

- A. Before starting any work, examine surfaces to receive paint finish for defects, which cannot be corrected by procedures specified under "Preparation of Surfaces", and which might prevent satisfactory results.
 1. Do not proceed with work until such conditions are corrected.

3.2 PREPARATION OF SURFACES

- A. Paints shall be applied only to surfaces that are completely free of surface moisture as determined by sight or touch. In no case shall paint be applied to surfaces upon which there is visible frost or ice.
- B. Ferrous Surfaces:
 1. Surfaces that have not been shop-coated shall be solvent cleaned to remove oil and grease. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be mechanically cleaned by power wire brushing or sandblasting.
 2. After cleaning, apply one coat of ferrous metal primer to all ferrous surfaces that are to receive paint other than asphalt varnish.
 3. Protect shop-coated metal from corrosion before and after installation by treating corroded areas immediately upon detection.
 4. Abraded or corroded spots on shop-coated surfaces shall be wire brushed and touched up with the same materials as the shop coat.
 5. All edge of repair shall be carefully feathered out on exposed surfaces.

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C. Galvanized Surfaces:

1. Galvanized surfaces to be painted shall be solvent cleaned and treated in accordance with Paint Manufacturer's directions.

D. Aluminum and Aluminum-Alloy Surfaces:

1. Aluminum and aluminum-alloy surfaces (except prefinished items) to be painted shall be solvent cleaned to remove oil and grease and then treated in accordance with Paint Manufacturer's directions.

3.3 APPLICATION

A. Method of Application:

1. Brush or rollers shall apply all paint in accordance with manufacturer's recommendations.
2. Spray painting may be used only upon Architect's written permission.

B. Sequence of Coats:

1. Allow sufficient time between successive coats to permit proper drying.
2. Modify as necessary to suit adverse weather conditions.
3. If Architect so directs, succeeding coats shall not be applied until he has had opportunity to inspect completed coat.

C. General Requirements for Workmanship:

1. Coverage and hide shall be complete.
 - a) Where color, stain, dirt, or undercoats show through final coat of paint, surface shall be covered by additional coats until paint film is of uniform finish, color, appearance, thickness, and coverage, at no additional cost to Owner.
2. Give special attention to insure that edges, corners, crevices, welds, and rivets receive film thickness equivalent to that of adjacent painted surfaces.
3. Touch up all scarred and abraded areas on shop-primed work after cleaning and smoothing down to avoid shoulders.
4. Rate of application shall not exceed average rate of coverage recommended by Manufacturer for type of surface involved.
5. Each coat of paint shall be perceptibly different shade of color.
6. Finished surfaces shall be free from runs, drops, ridges, waves, laps, sags, brush marks; and free of variations in color, texture and finish.

D. Workmanship for Exterior Painting:

1. Exterior door shall have tops, bottoms and side edges finished the same as the exterior faces of these doors.

E. Workmanship for Interior Painting;

1. Refinish a whole wall rather than spot-finish where a portion of the finish has been damaged or is unsatisfactory.
2. Remove electrical panel box covers and doors before painting wall. Paint separately and reinstall after all paint is dry.

3.4 PAINTING SCHEDULE

A. PAINTING SCHEDULE - EXTERIOR:

1. Ferrous Metal (100% Acrylic System)
 - a) Primer:

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- 1) One (1) Coat:
 - a) Duron: Dura Clad Universal Acrylic Metal Primer, 33-105.
 - b) Devoe: 4020PF Devflex DTM Primer & Flat Finish.
 - c) S-W: DTM Primer Finish B66W1.
 - b) Finish:
 - 1) Two (2) Coats:
 - a) Duron: Dura Clad DTM Acrylic Coating, Semi-Gloss 95-401, or Gloss 95-301.
 - b) Devoe: 4206QD Devflex Waterborne Semi-Gloss Enamel or 4208QD Devflex Waterborne Gloss Enamel.
NOTE: In areas subject to human contact apply 4216HP Devflex High Performance Waterborne Acrylic Semi-Gloss Enamel in lieu of 4206QD or 4208QD.
 - c) S-W: DTM Acrylic B66 W101.
2. Galvanized Metal and Aluminum (100% Acrylic System)
- a) Primer:
 - 1) One (1) Coat:
 - a) Duron: Dura Clad Universal Acrylic Metal Primer, 33-105.
 - b) Devoe: 4020PF Devflex DTM Primer & Flat Finish.
 - c) S-W: DTM Primer Finish B66W1.
 - b) Finish:
 - 1) Two (2) Coats:
 - a) Duron: Dura Clad DTM Acrylic Coating, Semi-Gloss 95-401, or Gloss 95-301.
 - b) Devoe: 4206QD Devflex Waterborne Semi-Gloss Enamel or 4208QD Devflex Waterborne Gloss Enamel.
NOTE: In areas subject to human contact apply 4216HP Devflex High Performance Waterborne Acrylic Semi-Gloss Enamel in lieu of 4206QD or 4208QD.
 - c) S-W: DTM Acrylic B66W101.

B. PAINTING SCHEDULE - INTERIOR

1. Ferrous Metal
 - a) Primer:
 - 1) One (1) Coat:
 - a) Duron: Dura Clad Alkyd Metal Primer White 33- 010.
 - b) Devoe: 4120 Devguard All-Purpose Metal & Galvanized Primer.
 - c) S-W: Kem Kromik Universal Metal Primer, B50Z Series.
 - b) Finish: (Latex)
 - 1) Two (2) Coats:
 - a) Duron: Plastic Kote Interior Acrylic Semi-gloss Enamel 122- Series.
 - b) Devoe: 4205 Devflex Acrylic Latex Semi-Gloss Enamel.
 - c) S-W: ProMar 200 Latex Semi-gloss Enamel.
2. Galvanized Metal
 - a) Primer:
 - 1) One (1) Coat:
 - a) Duron: Dura Clad Acrylic Latex Galvanized Metal Primer, 33- 100.
 - b) Devoe: 4120 Devguard All Purpose Metal & Galvanized Primer.
 - c) S-W: Galvite HS Primer.

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- b) Finish (Gloss):
 - 1) Two (2) Coats:
 - a) Duron: EverLast Interior Alkyd Semi-Gloss, 43-series.
 - b) Devoe: 1516 Ultra-Hide Alkyd Semi-Gloss Enamel.
 - c) S-W: ProMar 400 Alkyd Semi-gloss Enamel B34 Series.

- 3. Masonry Substrates:
 - 1) Latex System - MPI INT 4.2A:
 - a) Block Filler: Block filler, latex, interior/exterior, MPI #4.
S-W Loxon Block Surfacer.
 - b) Intermediate Coat: S-W Loxon Concrete and Masonry Primer
 - c) Topcoat: Finish: Two (2) Coats: S-W: Pro Industrial Pre-Catalyzed Water Based Epoxy, Semi-gloss finish.

- 4. Gypsum Board Walls and Ceilings, Eggshell (100% Acrylic System)
 - a) Primer:
 - 1) One (1) Coat:
 - a) Duron: Interior Acrylic Latex Drywall Primer, 04-124.
 - b) Devoe: LM9116 Prep & Prime Odor-Less Water-Based Primer-Sealer.
 - c) S-W: PrepRite High Build Interior Latex Primer/Surfacer B28W601.
 - b) Finish: (Eggshell)
 - 1) Two (2) Coats:
 - a) Duron: Genesis Interior Odor Free Acrylic Latex Low Sheen Enamel, 79-Series.
 - b) Devoe: LM9300 Lifemaster 2000 Eggshell.
 - c) S-W: ProMar Interior Latex 200 or 400 (B30W200 or B30W400) or Health-Spec Eggshell.

END OF SECTION 09910

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SECTION 15010 - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Bidding.
 - 2. Existing conditions.
 - 3. Coordination.
 - 4. Examination.
 - 5. Installation.

1.3 QUALITY ASSURANCE

- A. Contractor shall be appropriately licensed by the North Carolina State Board of Examiners of Plumbing, Heating and Fire Sprinkler Contractors for the Work being performed.
- B. Comply with North Carolina State Building Code, Fire Prevention Code, Fuel Gas Code, Plumbing Code, Mechanical Code and Energy Conservation Code.
- C. Codes and standards referenced in the Drawings and Specifications shall be the latest edition of the code or standard as of the date on the Drawings and Specifications, unless noted otherwise.
- D. Where products are specified to be "tested," "listed," "labeled," "certified," "classified," or any combination thereof, the testing, listing, labeling, certification, and/or classification shall be provided by an OSHA Nationally Recognized Testing Laboratory in accordance with the specified standard(s).
- E. All products shall be new and shall be the manufacturer's current production first quality products. Seconds, rejects, damaged or previously used products shall not be provided.
- F. The presence of a manufacturer's name in the Specifications does not automatically infer that the manufacturer's products have been reviewed by the Architect/Engineer for compliance with the specified requirements. All products shall meet the requirements of the Specifications unless deviations are approved in writing by the Architect/Engineer.
- G. The Contractor shall provide all equipment, materials and labor as required for a complete and functional Project unless certain portions of Work are specifically identified as "by others," "by Owner," "not in contract" or similar wording.

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PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 BIDDING

- A. Bidders shall visit the Project site prior to submitting their bid to examine existing conditions and the extent and nature of the Work required. Any observed difficulties in complying with the Contract Documents shall be brought to the attention of the Architect/Engineer prior to submitting a bid. No additional compensation, either monetary or time, will be granted for failure to visit the site and observe existing conditions. It is not expected that Bidders be required to trace out each and every system component during this site visit, only that each Bidder makes a reasonable attempt at generally observing existing conditions, both above and below ceilings. In the event of a dispute, the Architect/Engineer will be the sole judge of whether certain existing conditions could have been reasonably observed through a site visit.
- B. The design contained in the Contract Documents is based on specific products as indicated by manufacturer and model number. When products are proposed by manufacturers other than those specified by model number, the Bidder shall be responsible for verifying that such products will meet the design intent (dimensions, capacities, electrical requirements, etc.). Any additional costs associated with providing such products, including but not limited to increasing the capacity of electrical services (disconnects, breakers, wiring, conduit, etc.), increasing housekeeping pad sizes, providing additional structural support or installation of equipment in different orientations/locations than indicated on the Drawings shall be included in the Bidder's bid to perform the Work.
- C. All costs for required governmental agency fees, permits and inspections shall be included in each Bidder's bid to perform the Work.

3.2 EXISTING CONDITIONS

- A. In areas where the existing ceilings are not demolished as part of this Project, remove and reinstall the existing ceilings as required for proper execution and completion of the Work.
- B. Existing conditions that are not indicated to be demolished but are damaged as a result of the Work shall be repaired or replaced by the Contractor to match existing adjacent conditions without additional cost to the Owner.
- C. Verify existing conditions and measurements prior to execution of the Work. Some or all information about existing conditions shown on the Drawings may be based solely on existing record drawings and may or may not have been verified by the Architect/Engineer.
- D. Verify locations and invert elevations of existing sanitary and storm drain piping located below grade or below slab at all connection points (new to existing) prior to extensive excavation and/or removal of existing concrete slabs. Verify that locations and/or invert elevations of existing drain piping does not prevent installation and connection of new piping at proper slopes. Notify Architect/Engineer immediately if conditions are found which are substantially different than expected.

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3.3 COORDINATION

- A. The Drawings are diagrammatic in nature unless dimensions are indicated. The actual routing of ductwork, piping, conduit, etc. shown on the Drawings shall suit actual field conditions. All ductwork, piping, conduit, etc. shall be routed as high as possible with priority given to systems that must be installed at a specified slope. Coordinate all Work with all other trades.
- B. When installed in lay-in ceilings, equipment or devices shall be centered within ceiling tiles.
- C. When installed in gypsum board ceilings, equipment or devices shall be coordinated and lined up with equipment or devices of all other trades. For example, fire sprinklers should line up with light fixtures and smoke detectors.
- D. Work to be performed above, below, near or inside occupied spaces shall be coordinated with the Owner. All or some portions of this Work may be required to be performed at night or on weekends to minimize disruption to the Owner's normal operations. The costs for "after hours" labor shall be included in the Contractor's bid to perform the Work. When Work is to be performed inside occupied spaces, cover all electronic equipment located in those spaces with fire-retardant plastic sheeting and clean the work area thoroughly after the Work is completed.
- E. Shutdown of existing systems for the connection of new services shall be coordinated with the Owner. All or some portions of this Work may be required to be performed at night or on weekends to minimize disruption to the Owner's normal operations. The costs for any required "after hours" labor shall be included in the Bidder's bid to perform the Work.

3.4 EXAMINATION

- A. Examine rough-ins for piping systems to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 INSTALLATION

- A. All products shall be installed in strict accordance with the manufacturer's written installation instructions.

END OF SECTION 15010

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SECTION 15050 - BASIC MATERIALS AND METHODS

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. Structural steel.
 - 2. Lightweight steel channel.
 - 3. Demolition.
 - 4. Cutting and patching.
 - 5. Firestopping and fireproofing.
 - 6. Piping installation.
 - 7. Piping joint construction.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A36, carbon steel plates, shapes and bars.
 - 1. Finish:
 - a. Indoor Locations: Factory-primed or shop-primed.
 - b. Outdoor Locations: ASTM A123, hot-dip galvanized.
- B. Lightweight Steel Channel: ASTM A1011, cold-formed low carbon strip steel, fabricated into slotted struts; with matching fittings.
 - 1. Finish:

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- a. Indoor Locations: Manufacturer's standard baked enamel or powder coat finish.
- b. Outdoor Locations: ASTM A123 and ASTM A153, hot-dip galvanized.

PART 3 - EXECUTION

3.1 DEMOLITION

- A. Unless noted otherwise, demolish all equipment, ductwork, piping, conduit, etc. as required for proper execution and completion of the Work, whether specifically indicated on the Drawings or not. All systems shall be demolished back to the source and capped appropriately. The Owner has the right of first refusal for all items that are removed. Remove all items refused by the Owner from the Project site and properly disposed of in accordance with all laws and regulations.
- B. Existing items that are indicated to be removed and reinstalled/relocated shall be removed with due care and diligence, inspected for proper operation, thoroughly cleaned and prepared for reinstallation. Any required repairs other than minor adjustments shall be brought to the attention of the Architect/Engineer. Storage of items shall be the responsibility of the Contractor until reinstallation.
- C. Existing items that are indicated to be removed and turned over to Owner shall be removed with due care and diligence, inspected for proper operation, thoroughly cleaned and delivered to the Owner's designated storage area. Any required repairs other than minor adjustments shall be brought to the attention of the Owner.

3.2 CUTTING AND PATCHING

- A. Cut and patch (including concrete saw-cutting and core-drilling) as required for proper execution and completion of the Work. All patching shall match existing adjacent finishes unless noted otherwise. When saw-cutting or core-drilling through roof slabs or elevated floor slabs the Contractor shall be responsible for verifying the location of all structural beams under the slab prior to cutting or drilling.

3.3 FIRESTOPPING AND FIREPROOFING

- A. Seal all new piping and conduit penetrations through new and existing walls, floors, roofs, etc. to maintain the integrity and/or rating of the assembly. Membrane penetrations that penetrate only one side of an assembly shall be treated the same as through-penetrations.
 - 1. Fire-Resistance-Rated Vertical Assemblies (Walls and Partitions): Seal penetrations using through-penetration firestop systems tested and classified in accordance with ASTM E814 or UL 1479 with a minimum positive differential pressure of 0.01 inches wg.
 - a. F Rating: Equal to or exceeding the fire-resistance-rating of the assembly.
 - b. L Rating (Smoke Barriers Only): Less than or equal to 5 cfm per square foot of penetration opening at 0.3 inches wg at both ambient and elevated temperature.
 - 2. Fire-Resistance-Rated Horizontal Assemblies (Floors and Roofs): Seal penetrations using through-penetration firestop systems tested and classified in accordance with ASTM E814 or UL 1479 with a minimum positive differential pressure of 0.01 inches wg.

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- a. F Rating: Equal to or exceeding the fire-resistance-rating of the assembly.
 - b. T Rating: Equal to or exceeding the fire-resistance-rating of the assembly, but not less than 1 hour.
 - c. L Rating (Smoke Barriers Only): Less than or equal to 5 cfm per square foot of penetration opening at 0.3 inches wg at both ambient and elevated temperature.
3. Non-Fire-Resistance-Rated Assemblies (Vertical and Horizontal): Seal using methods and materials consistent and compatible with the assembly construction (gypsum joint compound, mortar, grout, caulk, etc.).
- B. When spray fireproofing on building structural members is removed or damaged by installation of hangers and supports, the fireproofing shall be patched to match the existing adjacent material and thickness.

3.4 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Indicated locations and arrangements are used to size pipe and calculate friction loss and other design considerations. Install piping as indicated unless deviations to layout are approved by Architect/Engineer.
- B. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- E. Install piping to permit valve and equipment servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. When installing piping adjacent to equipment, allow space for service and maintenance.
- J. Install unions in piping NPS 2 and smaller on both sides of flow indicators, vacuum breakers, backflow preventers, pressure reducing valves, pressure regulators, balancing valves, automatic flow limiting valves, mixing valves, control valves, pumps, steam traps and other similar devices that may require removal for maintenance or replacement.
- K. Install flanges in piping NPS 2-1/2 and larger on both sides of backflow preventers, balancing valves, automatic flow limiting valves, control valves, pumps, air separators and other similar devices that may require removal for maintenance or replacement.
- L. Install unions in piping NPS 2 and smaller or flanges in piping NPS 2-1/2 and larger at final connections to each piece of equipment.

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- M. Install piping to allow application of insulation where specified.
- N. Select system components with pressure rating equal to or greater than system design pressure.
- O. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- P. Do not enclose, cover or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Q. Install escutcheons for exposed piping penetrations of walls, ceilings and floors.
- R. Do not install piping directly above electrical equipment such as panelboards and transformers.

3.5 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

END OF SECTION 15050

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SECTION 15062 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry, Inc.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon Steel Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Finish:
 - a. Indoor Locations: ASTM A653, pre-galvanized.
 - b. Outdoor Locations: ASTM A123, hot-dip galvanized.
 - c. Locations in Direct Contact With Copper Tubing: Copper-plated, plastic-coated, epoxy-coated or containing rubber insert; specifically designed to provide isolation of dissimilar metals.
 - 3. Hanger Rods: Continuous-thread rod, nuts and washer made of zinc-coated carbon steel.

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PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps and attachments as required to properly support piping from the building structure.
- B. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers and other accessories.
- C. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
- D. Install lateral bracing with pipe hangers and supports to prevent swaying.
- E. Install building attachments within concrete slabs or attach to structural steel or wood framing. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- F. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

3.2 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.3 PAINTING

- A. Galvanized Surfaces: Clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.4 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

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- C. Horizontal Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.

- D. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Protection Shields (MSS Type 40): Install on all piping systems NPS 2 and smaller. Of length recommended in writing by manufacturer to prevent crushing insulation, but not less than the following.
 - a. 12 inches long and 0.048 inch thick.

- E. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

END OF SECTION 15062

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SECTION 15086 - INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulation for the following systems:
 - 1. Supply ducts.
 - 2. Domestic cold water piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface Burning Characteristics: Tested and labeled in accordance with ASTM E84 "Standard Test Method for Surface Burning Characteristics of Building Materials."
 - 1. Duct Insulation: Flame spread index of 25 or less, and smoke developed index of 50 or less.
 - 2. Piping Insulation: Flame spread index of 25 or less, and smoke developed index of 450 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

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1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers and insulation shields.
- B. Coordinate clearance requirements with duct and piping Installers for duct and piping insulation application.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Certainteed.
 - 2. Johns Manville.
 - 3. Knauf Insulation.
 - 4. Owens Corning Insulating Systems, LLC.
- B. Products shall not contain asbestos, lead, mercury or mercury compounds.
- C. Glass Fiber Blanket Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type III with factory-applied FSK jacket.
 - 1. Basis of Design: Owens Corning SOFTR Duct Wrap FRK.
- D. Glass Fiber Preformed Pipe Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied ASJ-SSL.
 - 1. Basis of Design: Owens Corning FIBERGLAS Pipe Insulation.

2.2 INSULATING CEMENTS

- A. Glass Fiber Insulating Cement: Comply with ASTM C195.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Glass Fiber Adhesive: Comply with ASTM C916 and MIL-A-3316C, Class 2, Grade A.

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- C. ASJ and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor Barrier Mastic: Water-based; suitable for indoor use on below ambient services.
 - 1. Water Vapor Permeance: ASTM E96, Procedure B, 0.013 perm at 43 mil dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 3. Solids Content: ASTM D1644, 58 percent by volume and 70 percent by weight.
 - 4. Color: White.

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ-SSL: White, kraft paper, fiberglass-reinforced scrim with aluminum foil backing; self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
 - 2. FSK Jacket: Aluminum foil, fiberglass-reinforced scrim with kraft paper backing; complying with ASTM C1136, Type II.

2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- B. PVC Pipe Fitting Covers: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C.
 - 1. Color: White.
 - 2. Shapes: 45 and 90 degree, short and long radius elbows, tees, valves, flanges, unions, reducers and end caps.

2.7 TAPES

- A. ASJ Tape: White vapor retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 11.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

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- B. FSK Tape: Foil-face, vapor retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing. Insulation materials that become wet shall be removed and replaced.

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- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams and penetrations in insulation at hangers, supports, anchors and other projections with vapor barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Do not use wood blocking in lieu of specified saddles or shields. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3 inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches on center.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches on center.
 - a. For below ambient services, apply vapor barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- M. Cut and install blanket insulation in a manner to avoid compressing insulation to less than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. Install insulation sections with ends tight to the surface being insulated. Seal ends of insulation sections with vapor barrier mastic identical to the exterior surface as specified for each application.
- Q. For above ambient services, do not install insulation to the following:

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1. Vibration control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Non-Fire-Resistance-Rated Interior Wall and Partition Penetrations:
Install insulation continuously through walls and partitions.
- B. Pipe Insulation Installation at Fire-Resistance-Rated Interior Wall and Partition Penetrations:
Install insulation continuously through walls and partitions.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Insulation Installation on Fittings, Valves, Strainers, Flanges and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions and other specialties with continuous thermal and vapor barrier integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing box studs, bolts and nuts. Fill joints, seams and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with vapor barrier mastic.
 8. Install fitted PVC covers over elbows, tees, strainers, valves, flanges and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing.

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9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- B. Insulate instrument connections for thermometers, pressure gauges, pressure temperature taps, test connections, flow meters, sensors, switches and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic and flashing sealant.
- C. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel bands.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.6 INSTALLATION OF GLASS FIBER INSULATION

- A. Insulation Installation on Ducts and Plenums: Secure with adhesive.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2 inch outward-clinching staples, 1 inch on center. Install vapor barrier consisting of factory or field-applied jacket, adhesive, vapor barrier mastic and sealant at joints, seams and protrusions.
 - a. Repair punctures, tears and penetrations with tape or mastic to maintain vapor barrier seal.
 4. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat oval duct elbows with individually mitered gores cut to fit the elbow.
 5. Insulate duct stiffeners, hangers and flanges that protrude beyond insulation surface with 6 inch wide strips of same material used to insulate duct.
- B. Insulation Installation on Straight Pipes and Tubes:

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1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward-clinched staples at 6 inches on center.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 INSULATION SCHEDULE, GENERAL

A. Items Not Insulated:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration control devices.
5. Factory-insulated access panels and doors.
6. Drainage piping located in crawl spaces.
7. Underground piping.
8. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

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3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, supply duct and plenum insulation (including tops of diffusers) shall be the following:
 - 1. Glass Fiber Blanket: 2 inches thick, 0.75 lb/cu. ft. nominal density, 5.0 minimum installed R-value at 75 deg F mean temperature, with vapor barrier.

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Glass Fiber, Preformed Pipe Insulation: 1 inch thick, with vapor barrier.

END OF SECTION 15086

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SECTION 15140 - DOMESTIC WATER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes and fittings.
 - 2. Wall hydrants.

1.3 PERFORMANCE REQUIREMENTS

- A. Domestic water piping, components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
 - 1. 125 psig at 180 deg F.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. NSF Compliance: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for materials that will be in contact with potable water.

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1.8 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner unless permitted under the following conditions:
 - 1. Notify Owner no fewer than fourteen 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 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B88, Type L water tube, drawn temper.
- B. Wrought Copper, Solder Joint Fittings: ASME B16.22, wrought copper pressure fittings.
- C. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast copper alloy, hexagonal stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder joint or threaded ends.
- D. Wrought Copper, Pressure Seal Joint Fittings: Wrought copper fittings with EPDM rubber O-ring seal in each end.

2.2 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B32, lead-free alloys.
- B. Flux: ASTM B813, water flushable.

2.3 WALL HYDRANTS

- A. Exposed Non-Freeze Wall Hydrants:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jay R. Smith Manufacturing Company.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Watts Water Technologies, Inc.
 - e. Woodford Manufacturing Company; WCM Industries, Inc.
 - f. Zurn Industries, LLC.
 - 2. Standard: ASME A112.21.3M for exposed outlet, self-draining wall hydrants.
 - 3. Operation: Wheel handle.
 - 4. Inlet: NPS 3/4 or NPS 1.

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5. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
6. Nozzle Finish: Chrome.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Install copper tubing according to CDA "Copper Tube Handbook."
- B. Install domestic water piping level without pitch and plumb.

3.2 JOINT CONSTRUCTION

- A. Soldered Joints: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA "Copper Tube Handbook."
- B. Pressure Seal Joints: Join copper tube and pressure seal fittings with tools recommended by fitting manufacturer.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 15062 "Hangers and Supports."
- B. Support vertical piping and tubing at base and at each floor.
- C. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 3/4 and Smaller: 5 feet with 1/4 inch rod.
- D. Install supports for vertical copper tubing every 10 feet.

3.4 CONNECTIONS

- A. Connect domestic water piping to existing systems. Use transition fitting to join dissimilar piping materials.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

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- b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
2. Piping Tests:
- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure per ASME B31.9. Test pressure shall not exceed pressure rating for any component in system under test.
 - e. Isolate test source and allow it to stand for one hour. Leaks and loss in test pressure constitute defects that must be repaired.
 - f. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - g. Prepare reports for tests and for corrective action required.
- B. Domestic water piping and specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
- 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:

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- 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
- c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.7 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Aboveground, domestic water piping, shall be one of the following:
1. Copper tube; wrought copper, solder joint fittings; and soldered joints.
 2. Copper tube; wrought copper pressure seal joint fittings; and pressure sealed joints.

END OF SECTION 15140

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SECTION 15150 - DRAINAGE AND VENT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.

1.3 PERFORMANCE REQUIREMENTS

- A. Drainage and vent piping, components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
 - 1. Sanitary Drain, Waste and Vent Piping: 10 foot head of water.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

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1.8 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary or Storm Drainage Service: Do not interrupt drainage service to facilities occupied by Owner unless permitted under the following conditions:
 - 1. Notify Owner no fewer than fourteen 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 PVC PIPE AND FITTINGS

- A. Solid Wall PVC Pipe: ASTM D2665, drain, waste and vent.
- B. Cellular Core PVC Pipe: ASTM F891, Schedule 40.
- C. PVC Socket Fittings: ASTM D2665, made to ASTM D3311, drain, waste and vent patterns.
- D. Adhesive Primer: ASTM F656.
- E. Solvent Cement: ASTM D2564.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Make changes in direction for drainage and vent piping using appropriate branches, bends and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back-to-back or side-by-side with common drain pipe. Straight tees, elbows and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- B. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- C. Install drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Vent Piping: 1/8 inch per foot (1 percent) down toward vertical fixture vent or toward vent stack.
- D. Install aboveground PVC piping according to ASTM D2665.

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3.2 JOINT CONSTRUCTION

- A. Plastic Piping, Solvent Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers and solvent cements.
 - 2. PVC Piping: Join according to ASTM D2855 and ASTM D2665 Appendixes.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 15062 "Hangers and Supports."
- B. Support horizontal piping within 12 inches of each fitting and coupling.
- C. Support vertical piping at base and at each floor.
- D. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2: 4 feet with 3/8 inch rod.
 - 2. NPS 2: 4 feet with 3/8 inch rod.
 - 3. NPS 3: 4 feet with 1/2 inch rod.
 - 4. NPS 4: 4 feet with 5/8 inch rod.
- E. Install supports for vertical PVC piping every 48 inches.

3.4 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

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3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10 foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.5 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.6 PIPING SCHEDULE

- A. Aboveground, drainage and vent piping shall be the following:
 1. Solid wall or cellular core PVC pipe, PVC socket fittings, and solvent cemented joints.

END OF SECTION 15150

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SECTION 15815 - METAL DUCTWORK

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. Single-wall rectangular ducts and fittings.
 - 2. Single-wall round ducts and fittings.
 - 3. Sheet metal materials.
 - 4. Sealants and gaskets.
 - 5. Hangers and supports.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Sealants and gaskets.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality control reports.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of duct liner materials and adhesives, with requirements indicated. Include dates of tests and test methods employed.

1.5 QUALITY ASSURANCE

- A. ASHRAE Compliance: Comply with ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start-up" and ASHRAE 90.1, Section 6.4.4 "HVAC System Construction and Insulation."
- B. SMACNA Compliance: Comply with SMACNA "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations and other imperfections. Comply with SMACNA "Duct Cleanliness for New Construction Guidelines" for protection, delivery, storage, installation and cleaning of duct systems and components.

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PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA "HVAC Duct Construction Standards - Metal and Flexible."
- D. Tees and Laterals: Select types and fabricate according to SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA "HVAC Duct Construction Standards - Metal and Flexible."

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2.3 SHEET METAL MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A653.
 - 1. Galvanized Coating Designation: G60.
- B. Reinforcement Shapes and Plates: ASTM A36, steel plates, shapes, and bars; galvanized.
- C. Tie Rods: Galvanized steel, 1/4 inch minimum diameter for lengths 36 inches or less; 3/8 inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface burning characteristics for sealants and gaskets shall be a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested according to UL 723; certified by an OSHA Nationally Recognized Testing Laboratory.
- B. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Maximum Static Pressure Class: 10 inches wg, positive and negative.
 - 8. Service: Indoor or outdoor.
 - 9. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.
- C. Flanged Joint Sealant: Comply with ASTM C920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
 - 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods: Zinc-plated steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

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- D. Trapeze and Riser Supports:
 - 1. Supports for Galvanized Steel Ducts: Galvanized steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct systems. Indicated locations and arrangements are used to size duct and calculate friction loss and other design considerations. Install duct systems as indicated unless deviations to layout are approved by Architect/Engineer.
- B. Install ducts according to SMACNA "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through electrical equipment rooms.
- J. Where ducts pass through non-fire-resistance-rated interior partitions, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Do not install ducts directly above electrical equipment such as panelboards and transformers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with Intermediate Level Cleanliness requirements in SMACNA "Duct Cleanliness for New Construction Guidelines."

3.2 DUCT SEALING

- A. Seal ducts for duct static pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with procedures in SMACNA "HVAC Duct Construction Standards - Metal and Flexible."

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3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural steel or wood framing fasteners appropriate for construction materials to which hangers are being attached.
- C. Hanger Spacing: Comply with SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 DUCT SCHEDULE

- A. Supply Ducts:
 - 1. Pressure Class: Positive 2 inches wg.
 - 2. Seal Class: A.
- B. Exhaust Ducts:
 - 1. Pressure Class: Positive 2 inches wg.
 - 2. Seal Class: A.
- C. Elbow Configuration:
 - 1. Rectangular Supply and Exhaust Duct: Comply with SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-width ratio.
 - b. Mitered Type RE 2 with vanes complying with SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - 2. Round Supply and Exhaust Duct: Comply with SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Adjustable with minimum radius-to-diameter ratio of 1.5.

END OF SECTION 15815

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SECTION 15820 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Flexible ducts.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For duct accessories to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. SMACNA Compliance: Comply with SMACNA "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations and other imperfections. Comply with SMACNA "Duct Cleanliness for New Construction Guidelines" for protection, delivery, storage, installation and cleaning of duct systems and components.

PART 2 - PRODUCTS

2.1 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Anco Products; Retek Engineering Solutions.

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2. ATCO Rubber Products, Inc.
 3. Flexmaster USA; Masterduct, Inc.
 4. GAF.
 5. Hart & Cooley, Inc.
 6. J.P. Lamborn Company.
 7. QuietFlex Manufacturing Company, LP.
 8. Thermaflex.
- B. Insulated, Flexible Duct: UL 181 listed and labeled, Class 1, polyethylene inner film supported by helically wound, spring-steel wire; fiberglass insulation; aluminized fiberglass-reinforced vapor barrier outer film.
1. Basis of Design: Thermaflex M-KE or equal.
 2. Pressure Rating: 10 inches wg positive and 1.0 inch wg negative for sizes up to 12 inches in diameter; 4 inches wg positive and 0.5 inch wg negative for sizes 14 inches to 20 inches in diameter.
 3. Maximum Air Velocity: 5000 fpm.
 4. Temperature Range: Minus 20 to plus 250 deg F.
 5. Insulation R-value: 6.0.
- C. Flexible Duct Straps:
1. Concealed Ducts: UL 181B-C listed and labeled, flexible nylon strap with integrated gear rack and open ratchet case; length as required to suit duct size.
- D. Flexible Duct Tape: UL 181B-FX listed and labeled, self-adhesive.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Install duct accessories of materials suited to duct materials.
- C. Connect diffusers and grilles to ducts with flexible duct using straps plus tape.
- D. Connect flexible ducts to metal ducts using straps plus tape.

END OF SECTION 15820

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SECTION 15950 - TESTING, ADJUSTING AND BALANCING

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. Balancing Air Systems:
 - a. Constant air volume systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting and balancing.
- D. TAB Agency: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For TAB agency and TAB personnel.
- B. Certified TAB reports. For phased projects, provide report for each phase as well as a final report for entire project.
- C. Sample report forms.
- D. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

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1.5 QUALITY ASSURANCE

- A. TAB Agency Qualifications: Engage a TAB agency certified by AABC or NEBB.
 - 1. TAB Engineer: Employee of the TAB agency and who is certified by AABC or NEBB as a TAB Engineer.
 - 2. TAB Technician: Employee of the TAB agency and who is certified by AABC or NEBB as a TAB Technician.
 - 3. TAB Agencies: Subject to compliance with requirements, provide services by one of the following:
 - a. Building Environmental Systems Testing, Inc.
 - b. Palmetto Air & Water Balance.
 - c. Research Air Flo, Inc.
 - d. The Phoenix Agency of North Carolina, Inc.
- B. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB agency's forms approved by Architect/Engineer.
- D. Instrumentation Type, Quantity, Accuracy and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Construction Phasing: For phased projects, perform TAB separately for each phase. After completion of entire Project, re-check and verify settings for previously completed phases and make adjustments as necessary.

1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

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PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gauge cocks, thermometer wells, flow control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- F. Examine system and equipment installations and verify that field quality control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine air terminal units, such as variable air volume boxes, and verify that they are accessible and their controls are connected and functioning.
- J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- K. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- L. Examine heat transfer coils for correct piping connections and for clean and straight fins.
- M. Examine system pumps to ensure absence of entrained air in the suction piping.

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- N. Examine operating safety interlocks and controls on HVAC equipment.
- O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Complete system readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC "National Standards for Total System Balance" or NEBB "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.
- C. Mark equipment and balancing devices, including damper control positions, valve position indicators, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.

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- C. For variable air volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Check airflow patterns from the outdoor air louvers and dampers and the return and exhaust air dampers through the supply fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air handling unit components.

3.5 PROCEDURES FOR CONSTANT AIR VOLUME SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - c. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air handling unit, rooftop unit, and other air handling equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 5. Obtain approval from Architect/Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in other Sections for air handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air handling unit performance.
 - 6. Do not make fan speed adjustments that result in motor overload. Consult equipment manufacturers about fan speed safety factors. Modulate dampers and measure fan

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motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 - 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 - 3. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
 - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than the dampers at air terminals.
 - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR TESTING, ADJUSTING AND BALANCING EXISTING SYSTEMS

- A. Perform a pre-construction inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 3. Check the refrigerant charge.
 - 4. Check the condition of filters.
 - 5. Check the condition of coils.
 - 6. Check the operation of the drain pan and condensate drain trap.
 - 7. Check bearings and other lubricated parts for proper lubrication.
 - 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
 - 1. New filters are installed.
 - 2. Coils are clean and fins combed.

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3. Drain pans are clean.
 4. Fans are clean.
 5. Bearings and other parts are properly lubricated.
 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 4. Balance each air outlet.

3.7 TOLERANCES

- A. Set system air flow rates and water flow rates within the following tolerances:
1. Air Flow Rates: Plus or minus 10 percent.

3.8 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field report data, include the following:
1. Pump curves.
 2. Fan curves.
 3. Manufacturers' test data.
 4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB agency.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.

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9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Data for air terminal units, including manufacturer's name, type, size, and fittings.
 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outside air, return and exhaust dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet and dry bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Settings for supply air, static pressure controller.
 - g. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Air terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Instrument Calibration Reports:
1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

END OF SECTION 15950

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SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:
 - 1. Submittals.
 - 2. Coordination drawings.
 - 3. Tests and inspections.
 - 4. Record drawings.
 - 5. Operation and maintenance manuals.
 - 6. Rough-in.
 - 7. Access.
 - 8. Electrical installations.
 - 9. Cutting and patching.
 - 10. Temporary services.
 - 11. Cleaning.

1.3 CODES AND STANDARDS

- A. Codes and standards referenced in the Construction Documents shall be the latest edition of the code or standard in effect as of the original release date of the Construction Documents, unless specifically indicated otherwise.
- B. Codes and standards referenced in the Construction Documents shall be used as minimum construction requirements. Where the Construction Documents indicate more stringent construction requirements than a referenced code or standard, the requirements of the Construction Documents shall govern and be followed.

1.4 SUBMITTALS

- A. General: Follow the procedures specified in Division 01 Section "Submittals."
- B. If a fault current study is required under a separate specification section, that completed fault current study shall be submitted prior to submittal of any electrical switchboards, panelboards or automatic transfer switches.

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1.5 COORDINATION DRAWINGS

- A. General: Follow the procedures specified in Division 01 Section "Project Coordination".

1.6 TESTS AND INSPECTIONS

- A. Give 14 days' advance notice for all testing and inspections required by the individual work sections. The Owner and Engineer reserve the right to witness all tests.
- B. Codes and standards referenced in the Construction Documents for tests and inspections shall be used as minimum testing and inspecting requirements. Where the Construction Documents indicate more stringent testing and inspecting requirements than a referenced code or standard, the requirements of the Construction Documents shall govern and be followed.
- C. Submit one (1) electronic PDF copy of the Final Reports as part of the closeout documents specified in Division 01 Section "Project Closeout".

1.7 RECORD DRAWINGS

- A. General: Follow the procedures specified in Division 01 Section "Project Closeout".
- B. Prepare record drawings to indicate the following installed conditions:
 - 1. Underground feeder locations.
 - 2. Concealed feeder locations.
 - 3. Panelboard, switchboard and MCC schedules.
 - 4. All circuits.
 - 5. All equipment locations.
 - 6. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
 - 7. All systems riser and control diagrams.

1.8 OPERATION AND MAINTENANCE MANUALS

- A. General: Follow the procedures specified in Division 01 Section "Project Closeout".
- B. Prepare operation and maintenance manuals include the following information:
 - 1. Manufacturer's printed operating procedures. Include start-up, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 - 2. Sequence of operation detailed description.
 - 3. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - 4. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 5. Servicing instructions and lubrication charts and schedules.

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1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- B. Retain shipping protective covers during storage.
- C. Comply with equipment manufacturer's written installation instructions for handling.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

- A. Equipment and materials, unless specified otherwise, shall be new and be the standard products of the manufacturer. Seconds, rejects, or damaged materials are not acceptable.
- B. Equipment and materials shall be the standard commercial grade product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer.
- C. The listing of a manufacturer for certain equipment and materials does not indicate acceptance of standard or catalogued item. All equipment and materials shall conform to the specifications and are subject to prior review and approval by the Engineer.

2.2 UL LISTING

- A. Wherein equipment is specified to be UL listed, the entire assembly shall be listed by Underwriters Laboratories, Inc. Any modifications to suit the intent of the specifications shall be performed in accordance with the National Electric Code and listed by UL.
- B. If UL listing is not available for any given piece of equipment, notify the Engineer who will discuss with the Owner to resolve the issue.

PART 3 - EXECUTION

3.1 ROUGH-IN

- A. Verify final locations for rough-in of equipment and material with field measurements and with the requirements of the actual equipment and material to be installed. Follow manufacturer's written installation instructions.
- B. Refer to Divisions 2 through 16 specifications for rough-in requirements of specified equipment and material.

3.2 ACCESS

- A. Generally, all concealed equipment and material requiring maintenance and/or operation are located above accessible type ceilings, or are exposed. Should any such elements be

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inaccessibly located in ceilings or walls, provide 24 by 24-inches square access doors (whether shown on the Drawings or not) with flush screwdriver operated lock to permit complete access. Doors shall be of the type suited to the construction into which they are to be installed and shall conform with the type and quality of doors and panels specified in Division 8.

- B. Division 16 Contractors are responsible for furnishing and locating all access doors and panels for all inaccessibly concealed equipment and material. General Contractor is responsible for installation of all access doors and panels furnished by Division 16 Contractors.

3.3 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of Electrical systems, materials, and equipment. Comply with the following requirements:
1. Provide and maintain temporary partitions or dust barriers adequately to prevent the spread of dust and dirt to adjacent areas.
 2. Verify all dimensions by field measurements.
 3. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible, while allowing for proper drainage.
 4. Install systems, materials, and equipment to comply with approved submittal data, including coordination drawings. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, notify the Engineer of the conflict.
 5. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 6. Install equipment and material to facilitate servicing, maintenance, and repair or replacement of components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 7. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
 8. Provide access doors and panels for all inaccessibly concealed equipment and material behind finished surfaces.
 9. Where structural steel fireproofing is removed or damaged as a result of demolition or construction activities, patch and repair the fireproofing as required to match the type and thickness of adjacent undisturbed fireproofing material.
 10. Install all equipment so that all code required and manufacturer recommended servicing clearances are maintained. Contractor is responsible for the proper arrangement and installation of all equipment within any designated space. Should the Contractor determine that a departure from the Contract Documents is necessary, Contractor shall submit to the Designer, for approval, detailed drawings of his proposed changes with his written reasons for the changes. No changes shall be implemented by the Contractor without the issuance of the required Bulletin Drawings or clarifications.
 11. Electrical equipment shall be protected from the weather, in particular dripping or splashing water, at all times during shipment, storage, and construction. Manufacturer's recommendations with regard to storage and protection shall be followed. Should any apparatus be subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test, at the expense of the Contractor, to ascertain the suitability of the apparatus, or it shall be replaced without additional cost to the Owner.
 12. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair to new condition and test damaged equipment in compliance with industry standards at no

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additional cost to the Owner. Equipment required for any such testing shall be provided by the Contractor.

13. Wherever any work pierces waterproofing, it shall be installed in a manner to maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types with General Contractor.
14. In all cases where the conductor size has been increased to compensate for voltage drop and/or the conductor size is larger than the available lug size on a new or existing termination, provide a NEC sized junction box just ahead of that termination and reduce the wire size down to the maximum wire size listed for the termination lug. Keep the reduced wire size length to the minimum length possible. Provide UL listed insulated in line compression splices in the junction box with heat shrink insulation. Split bolt splices shall not be permitted. Do not cut strands off a stranded conductor to allow it to fit into a lug. In all cases the reduced wire size shall have ampacity larger than the circuit breaker or fuse protecting the circuit.
15. When adding circuit breakers to existing panels or switchboards, provide circuit breakers of the same manufacturer of the existing panel or switchboard, match the highest rated AIC rating of any existing circuit breakers in the panel or switchboards. Provide all mounting hardware as required to mount the circuit breaker. Provide dual breaker mounting hardware to mount new and adjacent existing circuit breaker if/as necessary. Drawings indicate the trip size of the circuit breaker required, not the frame size. Provide circuit breaker frame size to fit the space available, if the space available requires a larger frame size than trip rating called for, provide the larger frame size with a trip unit sized as specified. Provide all blank filler plates as required to completely cover the remaining panel trim. Relocate existing circuit breakers and extend existing circuits as required to make room for new circuit breaker. Provide new typed panel or switchboard schedule showing all panel or switchboard circuit changes. If circuit breakers for panel or switchboards are no longer available from the manufacturer, provide certified rebuild circuit breakers. Visit the jobsite and inspect the existing panels and switchboards that circuit breakers are to be added to prior to bid, provide aid of panel or switchboard manufacture as required to determine correct circuit breaker type for the panel or switchboard. Provide ground fault circuit breaker if other circuit breakers in panel or switchboard have ground fault.

3.4 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with the "General Conditions of the Contract for Construction" and Division 01 specifications. In addition to requirements specified in those documents, the following requirements apply:
 1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
 2. Minimize Noise: Core drill/saw cut concrete to avoid the use of jack hammers. Provide electrically powered welding machines in lieu of gas/diesel engines where receptacles are available.
- B. Perform cutting and patching for electrical equipment and materials required to:
 1. Uncover Work to provide for installation of ill-timed Work.
 2. Remove and replace defective Work.
 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 4. Remove samples of installed Work as specified for testing.
 5. Install equipment and materials in existing structures.
 6. Upon written instructions from the Architect and/or Engineer, uncover and restore Work to provide for observation of concealed Work.

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- C. Cut, remove and legally dispose of selected equipment, components, and materials indicated to be demolished, and other components made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

3.5 TEMPORARY SERVICES

- A. Provide temporary electrical services and lighting as detailed in Division 01 of these Specifications, and as specifically required to maintain progress of all trades and protect existing facilities.

3.6 CLEANING

- A. Prior to final acceptance of the project by the Owner, clean all equipment (inside and out) of all construction dust, dirt, and debris.
- B. Prior to final acceptance of the project by the Owner, clean all lighting fixtures and lenses of all construction dust, dirt, and debris. Replace all lamps in existing fixtures to remain. See the "Lighting Fixture Schedule" on the Drawings.

END OF SECTION 16010

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SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

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 the following:
 - 1. Grout.
 - 2. Electrical demolition.
 - 3. Equipment installation requirements common to equipment sections.
 - 4. Painting and finishing.
 - 5. Concrete bases.
 - 6. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than electrical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and electrical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 QUALITY ASSURANCE

- A. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting electrical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are appropriately increased. No additional costs will be approved for these increases, if larger equipment is approved. The Contractor is solely responsible for the form, fit, and function of substituted equipment. Any additional design cost incurred due to substituted equipment or other project changes shall be at the Contractor's expense.

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1.5 DELIVERY, STORAGE, AND HANDLING

- A. Electrical equipment shall be delivered to and stored in a dry space, do not store electrical equipment outdoors. Provide heat inside stored electrical equipment to prevent condensation.
- B. Protect all equipment and material from dirt, debris, and moisture.

1.6 COORDINATION

- A. Coordinate installation of electrical systems, equipment and materials with other building components.
- B. Notify the Owner of any system shutdowns three weeks prior to the shutdown, and coordinate shutdown requirements with the Owner. Obtain written approval from the Owner prior to proceeding with the shutdown.
- C. Coordinate with the Owner and Engineer for all required systems testing. Notify the Owner and Engineer two weeks prior to all testing.
- D. Arrange for adequate spaces, chases, slots, and openings in building structure during progress of construction, to allow for electrical installations.
- E. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- F. Coordinate, sequence, and integrate installations of electrical equipment and materials for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
- G. Coordinate connection of electrical services.
- H. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- I. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

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2.2 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 ELECTRICAL DEMOLITION

- A. Refer to Division 1 Sections "Cutting and Patching" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove electrical systems, equipment, and components indicated to be removed.

3.2 ELECTRICAL SYSTEMS INSTALLATION - COMMON REQUIREMENTS

- A. Install and support raceways independently of other system components.
- B. Do not allow other system components to be supported from, or come in contact with, fire-suppression system piping and components. Fire-suppression system piping and components shall be completely isolated from all other system components.

3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install electrical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

3.4 PAINTING

- A. Paint electrical systems, equipment, and components as specified in other sections of this specification.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

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3.5 CONCRETE BASES

- A. Interior Concrete Bases: Provide concrete bases for all floor-mounted equipment. Anchor equipment to concrete base according to equipment manufacturer's written instructions.
1. Unless indicated otherwise, construct 6-inch high concrete bases with chamfered edges of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 2. Unless indicated otherwise, install #4 reinforcing bars in concrete bases spaced at 12-inches on-center in each direction.
 3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement.
 8. Bases installed under this division shall be painted; painting shall conform to the Painting specification section of Division 9. Base color shall be chosen by the owner.
- B. Exterior Concrete Bases: Provide concrete bases for all grade-mounted equipment. Anchor equipment to concrete base according to equipment manufacturer's written instructions.
1. Unless indicated otherwise, construct 8-inch high concrete bases with chamfered edges of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 2. Excavate soil to 4-inches below grade and shape trench bottoms to provide uniform bearing and support of concrete bases.
 3. Unless indicated otherwise, install #4 reinforcing bars in concrete bases spaced at 12-inches on-center in each direction; top and bottom.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment. All outdoor metal supports shall be galvanized.

3.7 GROUTING

- A. Mix and install grout for electrical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.

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- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 16050

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SECTION 16120 –SECONDARY CONDUCTORS

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. Extent of work of the materials specified in this section is indicated by the Drawings and Schedules.
- B. Unless specifically indicated, all secondary conductors shall be to be installed in conduit.
- C. Types of electrical conductor, lugs, and connectors specified in this section include but are not limited to the following:
 - 1. Copper conductors, rated 600 V and less
 - 2. Tap type connectors.
 - 3. Split-bolt connectors.
 - 4. Wirenut connectors.
 - 5. Compression connectors.
 - 6. Compression lugs.
- D. Applications of electrical conductor and connectors required for this Project include but are not limited to the following:
 - 1. For power distribution circuits.
 - 2. For building lighting circuits.
 - 3. For appliance and equipment circuits.
 - 4. For motor-branch circuits.

1.3 ACTION SUBMITTALS

- A. General: Submit each item in this section in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product Data: For each type of product specified and utilized.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.

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1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Manufacturers: Firms regularly engaged in manufacture of electrical conductor products of types, sizes, and ratings required.
- C. NEC Compliance: Comply with NEC requirements as applicable to construction, installation and color coding of electrical conductors.
- D. UL Compliance: Provide wiring and connector products which are UL listed and/or labeled. Comply with UL Std. 486A.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver conductors properly packaged in factory-fabricated type containers, or wound on NEMA-specified type conductor reels.
- B. Store conductors in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- C. Handle conductors carefully to avoid abrading, puncturing and tearing conductor insulation. Ensure that dielectric resistance integrity of conductor is maintained.

1.7 COORDINATION

- A. Coordinate layout and installation of materials specified in this section with other installations.
- B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Engineer.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following (for each type of conductor):
 1. American Bare Conductor Incorporated
 2. Cerro Wire LLC
 3. Encore Wire Corporation.
 4. General Cable Technologies Corporation.
 5. The Okonite Company
 6. Service Wire Company
 7. Southwire Incorporated.
 8. United Copper Industries
- B. General: Provide electrical conductors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, for a complete installation, and for application indicated.
- C. Building Conductors: Provide factory-fabricated conductors of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper conductor selection as determined by Contractor to comply with project's installation requirements, NEC and NEMA standards.

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- D. Conductors No. 10 and smaller may be solid or stranded and conductors larger than No. 10 shall be stranded.
- E. Conductors manufactured more than twelve months prior to date of delivery to site shall not be used.
- F. Conductor Insulation:
 - 1. Type THHN/THWN-2 Comply with NEMA WC 70/ICEA S-95-658 and UL83.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Amp, Inc.
 - 2. Burndy Corp.
 - 3. Ideal Industries, Inc.
 - 4. IISCO
 - 5. O-Z/Gedney; a brand of the Emerson Industrial Automation Group.
 - 6. 3M; Electrical Products.
 - 7. Thomas & Betts Corp., a member off the ABB Group
- B. General: Provide UL type factory-fabricated metal connectors and splices of size, ampacity rating, materials, types, and classes for applications and for services indicated.
- C. General: Provide electrical connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, for a complete installation, and for application indicated.
- D. Where not indicated, provide proper selection as determined by the Installer to comply with the project's installation requirements, and with NEC and NEMA standards.
- E. Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications.
- F. Provide electrical insulating tape, wirenuts and ties as recommended for use by accessories manufacturers for type services indicated.
- G. Select from the following, those types, classes, kinds and styles of connectors to fulfill project requirements:
 - 1. Type: Pressure, threaded.
 - 2. Class: Insulated.
 - 3. Kind: Copper (for Cu to Cu connection).
 - 4. Style: Tap, pigtail, wirenut, split bolt, T-connections.
- H. Splices
 - 1. Splices of #6 wire and higher shall be compression splices. Crimp splices are unacceptable. Use of proper hydraulic tool and dies are required.

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PART 3 - EXECUTION

3.1 GENERAL

- A. Install conductors and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation", with equipment manufacturer's written instructions and in accordance with recognized industry practices.
- B. Coordinate conductor installation work including electrical raceway and equipment installation work, as necessary to properly interface installation of conductors with other work.
- C. This part of the specification indicates which wiring methods are permitted in different applications.

3.2 CONDUCTOR MATERIAL APPLICATIONS

- A. Provide copper conductors with conductivity of not less than 98% at 68°F.

3.3 CONDUCTOR INSULATION APPLICATIONS

- A. Select from the following UL types, those conductors with construction features which fulfill project requirements:
 - 1. Type THHN/THWN-2: For all locations except as noted; maximum operating temperature 90°C (194°F). Insulation, flame-retardant, moisture and heat-resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper.

3.4 INSTALLATION OF CONDUCTORS

- A. All conductors shall be run in conduit.
- B. Conceal conduit in finished walls, ceilings, and floors unless otherwise indicated.
- C. All branch circuit wiring requires dedicated neutrals.
- D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values. Do not use pulling compound or lubricant on isolated power system branch circuits.
- E. Use pulling means, including fish tape, rope, and basket-weave wire grips, that will not damage wiring or raceway.
- F. Remove existing conductors from raceway before pulling in new conductors.
- G. Use no conductor smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring (fire alarm).
- H. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet, unless otherwise noted on the Drawings.
- I. Use 10 AWG conductor for 20 ampere, 277 volt branch circuit home runs longer than 200 feet, unless otherwise noted on the Drawings.

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- J. Place an equal number of conductors for each phase of a circuit in same raceway, unless indicated otherwise on the Drawings.
- K. Make conductor lengths for parallel circuits equal.
- L. Pull conductors simultaneously where more than one is being installed in same raceway.
- M. Conductors of different systems or branches of the electrical distribution shall not be routed to the same raceways or enclosures. Normal, critical, life safety, and equipment branches shall all be routed independent of each other.
- N. Completely and thoroughly swab raceway system before installing conductors.
- O. Neatly train and lace wiring inside boxes, equipment and panelboards.
- P. All neutrals and ground wires in panels shall be labeled with numbered tape to indicate the circuits being served.
- Q. Where conductors are routed through junction boxes (without splicing), maintain at least a 6" loop in each conductor.
- R. Branch circuit wiring shall not loop through receptacle terminals, but shall be connected by means of conductor taps joined to branch circuit conductors. At end of run, branch circuit conductors may terminate on receptacle terminals.
- S. Position all splices in pull boxes and junction boxes of adequate volume so they are accessible from the removable cover side of the box.
- T. Conductors for signal systems shall be continuous and shall be terminated on terminal strips or terminate in a manner approved by the system's manufacturer.
- U. All splices of feeder conductors must be approved in advance by the Engineer.
- V. Panelboard feeders shall not be spliced under any circumstances. Carefully plan for continuous conductors between source and destination.
- W. Install all Isolated Power wiring per NEC requirements. Each circuit shall be pulled in a separate conduit. No pulling compound shall be used.

3.5 CONNECTIONS

- A. Splice only in accessible junction boxes.
- B. Keep conductor splices to minimum.
- C. Splices, taps and attachments of fittings and lugs shall be electrically and mechanically secure. Connectors and lugs shall be correct size for conductors jointed.
- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- E. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match

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conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

- F. Prepare conductors, by cutting and stripping jacket, and insulation properly to ensure uniform and neat appearance where conductors are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning conductor.
- G. Trim conductors as short as practicable and arrange routing to facilitate inspection, testing and maintenance.
- H. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque-tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A-486B.
- I. Install splices and taps which possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- J. Use splice and tap connectors which are compatible with conductor material.
- K. Solid conductors, namely those sized No. 10, No. 12 AWG copper, and smaller, shall be spliced by using Ideal "Wing-Nuts," 3M Co.'s "Scotchlox" or T&B "Piggy" conductors in junction boxes and light fixtures, except recessed fixtures as noted below.
 - 1. "Sta-Kon" or other permanent type crimp connectors shall not be used.
 - 2. Contractor shall use Ideal "Wing-Nuts" for splicing recessed lighting fixture leads to branch circuit conductors.
- L. Stranded conductors, namely No. 8 AWG and larger, shall be spliced by UL listed Hypress compression splices. Insulate splices with 3M Company shrinkable tubing. Solderless mechanical connectors, for splices and tape provided with UL listed insulating covers, may be used instead of mechanical connectors plus tape. Crimp type barrel splices are not permitted.
- M. Conductors, in all cases, shall be continuous from outlet to outlet, and no splicing shall be made except within outlet or junction boxes, troughs, and gutters.
- N. Connectors for conductors No. 6 through No. 1/0 AWG shall be copper, bolted compression. Connectors for conductors No. 2/0 AWG and larger shall be bolted compression.
- O. Taping of joints shall be made using special oil resistant vinyl plastic tape; UL listed, rated 105°C, Scotch Electrical Tape No. 33+ or reviewed equal.
- P. Thoroughly clean conductors before installing lugs and connectors.
- Q. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- R. Terminate spare conductors with electrical tape.
- S. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.
- T. Ensure that direction of rotation of each motor fulfills requirements.

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3.6 IDENTIFICATION - COLOR CODING AND MARKING:

- A. All conductors shall be color-coded in accordance with the following table. The only exception will be when directed in writing by either the Owner, the A/E, or a code enforcement authority to use a different code-compliant color scheme. **Conductors in new construction not meeting these requirements shall be replaced (IMPORTANT: Coordinate phase colors with Owner before proceeding with work. Get signed receipt on agreed upon color code, present to Engineer before pulling conductor):**
- | | | | |
|----|--------------------|------------|-----------------|
| B. | Conductor | Under 250V | 250V and higher |
| | Phase A | Black | Brown |
| | Phase B | Red | Orange |
| | Phase C | Blue | Yellow |
| | Neutral (grounded) | White | Natural Gray |
| | Ground (grounding) | Green | Green |
- C. Phase conductors sized #8 AWG and smaller shall be provided with the proper insulation color in manufacture. Phase conductors sized larger than #8 AWG may be identified with properly colored electrical tape.
- D. Grounded or grounding conductors sized #6 AWG and smaller shall be provided with the proper insulation color in manufacture. Grounded or grounding conductors sized # 4 AWG and larger may be identified with properly colored electrical tape.
- E. Neutral conductors shall have stripe or marking when required by NEC 200-6(d).
- F. All conductors, including neutrals, passing through accessible boxes shall be identified by wrap-around self-adhesive markers. Markers shall be of type manufactured for this use. Markers shall be either pre-numbered or write-on types with clear plastic cover. Numbering shall indicate circuit designation or conductor designation.
- G. All conductors being utilized for switch legs or travelers that pass through accessible boxes shall be identified by wrap-around self-adhesive markers. Markers shall be of type manufactured for this use. Markers shall be write-on types with clear plastic cover. Numbering shall indicate circuit designation with an "S" for switch leg or a "T" for traveler designation.

3.7 VERTICAL RISERS

- A. Provide vertical riser supports per article 300.19 in NEC, NFPA70. Conductor supports shall be OZ Gedney type S or approved equal and shall be located in accessible pullboxes or cabinets of adequate size. Provide adequate structural connection of conductor supports to pullbox or cabinet.

3.8 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.9 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

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3.10 FIELD QUALITY CONTROL

- A. Feeders and branch circuits AWG # 4 and larger shall have their insulation tested after installation and before connection to utilization devices such as fixtures, motors, or appliances.
- B. The Contractor shall furnish the instruments, materials, and labor for these tests.
- C. Follow all recommended safety procedures and standards for electrical conductor testing.
- D. Perform tests and inspections and prepare written test reports for each circuit. Provide a complete list of feeders arranged starting from the largest conductor size to the smallest. Provide feeder or circuit name and source and load name and readings at 30 seconds and 60 seconds and any times after 60 seconds that may be required for the reading to become constant.
- E. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
 - 1. Visual Inspection and Tests: Inspect physical condition.
 - 2. Uniform resistance test of parallel conductors.
 - 3. Electrical tests:
 - a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.
 - b. Applied voltage shall be 500 V DC for 300 V rated conductors, and 1000 V DC for 600 V rated conductors. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated conductors and 100 megohms for 600 V rated conductors.
- F. Discharge conductors properly after testing.
- G. Conductors will be considered defective if they do not pass tests and inspections. Defective conductors shall be replaced at contractor's expense.

END OF SECTION 16120

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SECTION 16130 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Nonmetal wireways and auxiliary gutters.
 - 5. Surface raceways.
 - 6. Boxes, enclosures, and cabinets.
 - 7. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. GRC or RSC or RMC: Galvanized rigid metal conduit.
- B. IMC: Intermediate metal conduit.
- C. EMT: Electrical metallic tubing.
- D. FMC: Flexible metal conduit.
- E. LFMC: Liquid tight flexible metal conduit.
- F. PVC: Polyvinyl Chloride.
- G. RNC: Rigid Nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
- C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

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- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Allied Tube & Conduit.
 2. Anamet Electrical, Inc.
 3. O-Z/Gedney.
 4. Picoma Industries.
 5. Republic Conduit.
 6. Robroy Industries.
 7. Southwire Company.
 8. Thomas & Betts Corporation.
 9. Western Tube and Conduit Corporation.
 10. Wheatland Tube Company.
 11. Polywater Duct Sealant.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. All locknuts and fittings shall be UL Listed 514B.
- D. GRC: Comply with ANSI C80.1 and UL 6.
- E. ARC: Comply with ANSI C80.5 and UL 6A.
- F. IMC: Comply with ANSI C80.6 and UL 1242.
- G. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- H. EMT: Comply with ANSI C80.3 and UL 797. If designated within the Construction Documents EMT conduit shall be manufactured in colors to match the noted requirements.
- I. FMC: Comply with UL 1; zinc-coated steel. All FMC and fittings shall be UL listed as suitable for grounding.
- J. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360 and shall be UL listed as suitable for grounding.
- K. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 2. Fittings for EMT:
 - a. Material: Steel
 - b. Type: compression (raintight) with insulated throats.

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3. Expansion Fittings: Steel, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
 5. All fittings shall be listed as grounding type.
- L. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.
- M. Quick-Setting Two-Part, Foam-Base Duct-Sealing System for sealing conduits.
1. Two part high expansion duct and conduit sealant. Sealant shall expand and harden to a "closed cell" rigid structure. Sealant shall be permanent but removable and completely seal raceway with conductors installed against passage of liquids, gasses or rodents. Product shall be UL listed and have class HFB fire retardant rating.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. AFC Cable Systems, Inc.
 2. Anamet Electrical, Inc.
 3. Arnco Corporation.
 4. CANTEX Inc.
 5. CertainTeed Corporation.
 6. Condux International, Inc.
 7. Electri-Flex Company.
 8. Kraloy.
 9. Lamson & Sessions.
 10. Niedax Inc.
 11. RACO; Hubbell.
 12. Thomas & Betts Corporation.
- B. Listing and Labeling: Nonmetallic conduits and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Fittings for RNC: Comply with NEMA TC 3; match to conduit material.
- E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Cooper B-Line, Inc.
 2. Hoffman.

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3. Mono-Systems, Inc.
 4. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 indoor, Type 3R outdoor, unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Mono-Systems, Inc.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.
- C. Tele-Power Poles:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Mono-Systems, Inc.
 - b. Panduit Corp.
 - c. Wiremold / Legrand.
 2. Material: Galvanized steel with ivory baked-enamel finish
 3. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Adalet.
 2. Crouse-Hinds, Eaton Corporation
 3. EGS/Appleton Electric.
 4. Erickson Electrical Equipment Company.
 5. FSR Inc.

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6. Hoffman; a Pentair Brand.
 7. Hubbell Incorporated.
 8. Kraloy.
 9. Milbank Manufacturing Co.
 10. Mono-Systems, Inc.
 11. O-Z/Gedney.
 12. RACO; Hubbell.
 13. Robroy Industries.
 14. Spring City Electrical Manufacturing Company.
 15. Stahlin Non-Metallic Enclosures.
 16. Thomas & Betts Corporation.
 17. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover. All outdoor covers shall be continuously weather proof type.
- E. Metal Floor Boxes:
1. Material: Cast metal.
 2. Type: Fully adjustable.
 3. Shape: Rectangular.
 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb. (23 kg) shall be listed and marked for the maximum allowable weight.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.
- I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- J. Device, Outlet and Data/Comm minimum Box Dimensions: 4 inches square by 2-1/8 inches deep.
- K. Gangable boxes are prohibited.
- L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 indoor and Type 3R outdoor with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- M. Cabinets:

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1. NEMA 250, Type 1 indoor and Type 3R outdoor galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC or IMC.
 2. Concealed Conduit, Aboveground: GRC or IMC.
 3. Underground Conduit (General Use): Type EPC-40-PVC
 4. All feeders over 600V: GRC or IMC.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 6. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Exposed in Truck bay.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Pumps, Generators, Daytanks: LFMC.
 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.
 7. Damp or Wet Locations: GRC or IMC.
 8. Conduit installed within 1 ½" of metal corrugated sheet roof decking shall be IMC or GRC.
 9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 1/2-inch trade size. 1/2" minimum FMC less than 6 foot long to light fixtures.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

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2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression steel fittings. Comply with NEMA FB 2.10
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.

3.2 RACEWAY AND BOX IDENTIFICATION

- A. Raceway system and box identification shall be per the "Electrical Identification" section of these specifications.

3.3 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Support raceways independently of other system components.
- D. Raceways above ceilings shall not be supported by walls or wall studs. All raceways above ceilings shall be suspended from the structure above either individually or on conduit racks.
- E. All conduit hangers shall be minimum ¼" diameter all thread rod with lock nuts and washers on each side of each fitting.
- F. Complete raceway installation before starting conductor installation.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- I. All metallic raceways shall be of 1/2" minimum size.
- J. All non-metallic raceways shall be of 1" minimum size.
- K. Individual flexible connections to light fixtures shall be no less than 1/2" in size and no longer than 6 feet. Fittings shall be listed.
- L. In no case shall any conduit be filled to over 40 percent of its cross-sectional area.

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- M. Fasten conduit securely to outlets, junctions and pullboxes to ensure firm electrical contact.
- N. Support conduit within 12 inches of box or enclosure to which attached. All supports shall be UL listed and specifically made for the purpose.
- O. Avoid condensation pockets in installations. Keep conduit, fittings, and boxes free from foreign matter, before, during and after installation.
- P. Not more than one (1) exposed conduit shall be run down to an exposed wall switch or outlet box.
- Q. Use thruwall sealing fittings where conduits enter buildings or vaults below finished grade. Fill annular opening around pipe with "link-seal" system for a water tight seal. All conduit passing through walls shall be sleeved with Schedule 40 black steel pipe.
- R. Install Quick-Setting Two-Part, Foam-Base Duct-Sealing System inside all conduits entering or leaving the building at the building perimeter or closed junction point. Install for both underground and overhead conduits penetrating the building. Sealing system shall prevent the entrance of gases, dampness, or rodents. Cured foam shall be semi-permanent and be able to be removed.
- S. Support conduit risers exposed in wire shafts at each floor level with approved U-clamp hangers.
- T. Install empty conduit for future use as indicated on the drawings. Conduit shall be complete with pullwire or rope, junction and outlet boxes.
- U. Conduit shall not be supported from metal roof deck or from ceiling support wires.
- V. Provide pitchpocket where conduit penetrates roof.
- W. All conduits shall be installed as high as possible in the ceiling cavity. Coordinate all conduit installation with ductwork, sprinkler, and/or mechanical piping.
- X. Above ceiling conduits shall be supported from structure above and shall not be run on or supported by wall studs or walls above the ceiling.
- Y. Install miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split coupling, and plugs that have been specifically designed and manufactured for their particular application.
- Z. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades and architectural elevations.
- AA. Conduits shall not cross pipe shafts or ventilating duct openings.
- BB. Support riser conduit at each floor level with clamp hangers.
- CC. All conduits shall be consolidated and run in conduit racks as much as possible. All racks shall be provided with a capacity for 50% future conduits. Racks shall be suspended from the structure above.
- DD. Arrange all conduits to maintain headroom and present a neat appearance.

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- EE. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines. Conduit not installed parallel or perpendicular to building lines shall be removed and properly reinstalled.
- FF. Raceways shall not be installed in or under concrete floor slabs without the prior approval of the A/E.
- GG. Raceways Embedded in Slabs:
 - 1. Conduit **shall not** be installed in slabs.
- HH. Raceways below slabs (where indicated):
 - 1. Conduit run below slab shall be a minimum of 6" below the slab.
 - 2. PVC conduit shall be changed over to GRC 18" minimum before penetrating and exiting the slab and shall include the last elbow.
- II. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- JJ. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- KK. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- LL. Raceway Terminations: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- MM. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- NN. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- OO. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- PP. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- QQ. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- RR. Surface Raceways:

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1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- SS. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- TT. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.
 3. Where otherwise required by NFPA 70.
- UU. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- VV. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 4. Install expansion fittings at all locations where conduits cross building or seismic expansion joints. Do not use flexible metal conduit, use expansion joints made for the purpose that include a ground strap.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

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- WW. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC in damp or wet locations not subject to severe physical damage.
- XX. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- YY. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- ZZ. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- AAA. Locate boxes so that cover or plate will not span different building finishes.
- BBB. Support all wall boxes by spanning two framing members on mounting on brackets specifically designed for the purpose. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- CCC. Set metal floor boxes level and flush with finished floor surface.

3.4 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in "Earthwork" for pipe less than 6 inches (150 mm) in nominal diameter.
 2. Install backfill as specified in "Earthwork."
 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in "Earthwork."
 4. Install manufactured duct elbows for stub-ups at light poles unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 5. Install manufactured galvanized rigid steel conduit elbows for stub-ups at equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend galvanized rigid steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment and bond elbows to equipment ground bar per NEC.

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6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits but a minimum of 6 inches (150 mm) below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in "Electrical Identification."

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in "Through-Penetration Firestop Systems."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 16130

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SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Weather-resistant receptacles.
 - 4. Snap switches and wall-box dimmers.
 - 5. Wall-switch and exterior occupancy sensors.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 3. Leviton Mfg. Company Inc. (Leviton).
 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

Product shall be equal to Hubbell HBL 5362 series
 - a. Cooper.
 - b. Hubbell.
 - c. Leviton.
 - d. Pass & Seymour.

2.4 GFCI RECEPTACLES

- A. General Description:
1. Straight blade, non-feed-through type.
 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.

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3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

Product shall be equal to Hubbell GFR 5362 SG series

- a. Cooper.
- b. Hubbell
- c. Pass & Seymour
- d. Leviton

2.5 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.6 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

Product shall be equal to Hubbell HBL 1221 series

- 1) Cooper
- 2) Hubbell.
- 3) Leviton.
- 4) Pass & Seymour.

2.7 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished, Type 302 stainless steel.

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3. Material for Unfinished Spaces: Galvanized steel.
 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof While-in-use Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum, extra-duty with lockable cover.

2.8 FINISHES

- A. Device Color:
1. Wiring Devices Connected to Normal Power System: Gray unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

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2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
10. Replace all existing wall plates with specified SS wall plates.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 16075 "Electrical Identification."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Test Instruments: Use instruments that comply with UL 1436.
 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

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- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

- C. Wiring device will be considered defective if it does not pass tests and inspections.

- D. Prepare test and inspection reports.

END OF SECTION 16140

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SECTION 16452 - GROUNDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. Division 16 Basic Materials and Methods sections apply to work of this section.
- C. Requirements of this section apply to electrical grounding and bonding work specified elsewhere in these specifications.
- D. Related work specified elsewhere includes:

1.2 SUMMARY

- A. Extent of electrical grounding and bonding work is indicated by the Drawings and Schedules and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.
- B. Type of electrical grounding and bonding work specified in this section includes the following:
 - 1. Solidly grounded.
- C. Applications of electrical grounding and bonding work in this section includes the following:
 - 1. Electrical power systems.
 - 2. Grounding rods.
 - 3. Separately derived systems.
 - 4. Raceways.
 - 5. Enclosures.
 - 6. Equipment.
 - 7. Transformers.
 - 8. Panelboards.
 - 9. Service Equipment.
 - 10. Area Lighting Fixtures.
- D. Refer to other Division 16 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work.

1.3 SUBMITTALS

- A. Submit each item in this section according to the condition of the contract and Division 1 specifications sections.
- B. Product Data: Submit manufacturer's data on grounding systems, grounding and bonding products and associated accessories.
- C. Qualification Data: For qualified testing agency and testing agency's field supervisor.

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- D. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Install grounding and bonding products of firms regularly engaged in the manufacture of these materials, including stranded cable, grounding rods, and bonding jumpers.
- B. Electrical Code Compliance: Comply with the applicable State electrical code requirements of the authority having jurisdiction, and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits and equipment.
- C. UL Compliance: Comply with applicable requirements of UL Standards No.'s 467, "Electrical Grounding and Bonding Equipment," and 869, "Electrical Service Equipment," pertaining to grounding and bonding of systems, circuits and equipment. In addition, comply with UL Standard 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products which are UL listed and/or labeled for their intended usage.
- D. NFPA Compliance: Comply with applicable requirements of NFPA 99, "Health Care Facilities" and NFPA 101, "Life Safety Code."
- E. IEEE Compliance: Comply with applicable requirements of IEEE Standards 142 and 241 pertaining to electrical grounding.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering grounding products which may be incorporated in the work include, but are not limited to, the following:
 - 1. B-Line Systems, Inc.
 - 2. Burndy Corporation.
 - 3. Crouse-Hinds Div.
 - 4. Cooper Industries.
 - 5. Electrical Components Div.
 - 6. General Electric Supply Co.
 - 7. Gould Inc.
 - 8. Ideal Industries, Inc.
 - 9. Thomas & Betts Corp.
 - 10. ERICO International Corporation.

2.2 MATERIALS AND PRODUCTS

- A. General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding rods, bonding jumpers, service arresters, and additional accessories needed for a complete installation.

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1. Where more than one type component product meets indicated requirements, selection is Contractor's option.
 2. Where materials or components are not indicated, provide products which comply with NEC and UL requirements and with established industry standards for those applications indicated.
- B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.
- C. Bonding Connectors, Terminals and Clamps: Provide electrical bonding connectors, terminals, lugs and clamps as recommended by bonding connector, terminal and clamp manufacturers for indicated applications. For welded connections, use exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Grounding Rods: Ground rods for artificial grounding electrodes shall be of the sectional driven type, round, cone-pointed, copper encased steel of not less than $\frac{3}{4}$ inch diameter. Minimum length shall be 10 feet. All connections below grade and in inaccessible locations shall be Thermite welded. Each rod shall be die stamped with identification of manufacturer and rod length. Rods shall be Copperweld or approved equal.
- E. Electrical Grounding Connection Accessories: Provide electrical insulating tape, bonding straps, as recommended by accessories manufacturers for type service indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify Designer in writing of conditions detrimental to proper completion of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS

- A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's "Standard of Installation," and in accordance with recognized industry practices to ensure that products comply with requirements.
- B. Install grounding systems as designed and submit certified test report on grounding system.
- C. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.
- D. Ground each separately-derived system neutral to building steel. Repair fire-proofing material.
- E. Connect together service entrance system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and cold water systems.

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- F. Provide a separate, insulated equipment grounding conductor from each device to ground buses in panelboards. Terminate each end on a grounding lug, bus, or insulated grounding bushing.
- G. Provide grounding system per the Drawings and Article 250 of the NEC. Provide green equipment grounding conductor for all electrical raceways.
- H. Connect grounding electrode conductors to building steel using a suitable grounding clamp and 2-3/4" x 10'-0" copper clad steel ground rods driven not less than six feet apart.
- I. Use minimum #2 AWG copper conductor for communications service grounding conductor. Leave 10 feet of slack conductor at terminal board.
- J. Provide insulated grounding bushings on all service entrance conduit terminations, feeder conduits in panelboards, junction boxes, transformers, etc. Bond together with equipment grounding conductor. Double locknuts shall be provided on all heavywall conduits
- K. Connect grounding electrode conductors to 1-inch diameter, or greater, metallic cold water pipe using a suitably sized ground clamp.
- L. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.
- M. Apply corrosion-resistant finish to field connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.
- N. Provide clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity.
- O. Provide a No. 12 THHN-THWN or THW green grounding jumper from the ground terminal of each receptacle and switch to a hex head sheet metal screw on the outlet box. Install a ground wire with all branch circuit lighting and power circuits; with all feeders to panels; and with circuits to all owner or sub-contractor furnished equipment and as indicated on the drawings.
- P. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
- Q. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least 6' from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- R. Grounding type receptacles shall be grounded with an equipment grounding conductor, sized per NEC, but not smaller than #12 AWG, routed with the branch circuit and connected to the equipment ground bus in the branch circuit panelboard. This equipment ground conductor shall

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also be bonded to the outlet box in which the receptacle is mounted. All plugstrips and metallic surface raceway shall contain a green insulated ground conductor from supply panel ground bus connected to grounding screw on each receptacle in strip and to strip channel. Conductor shall be continuous.

- S. All new and removed/reinstalled lighting fixtures in building interior and exterior fixtures shall be provided with a green grounding conductor solidly connected to unit. Individual fixture grounds shall be with lug to fixture body, generally located at point of electrical connection to the fixture unit.
- T. Grounding of transformers and enclosures of 120/208 V and 277/480 V "separately derived systems" shall be to the nearest grounding electrode, grounded structural steel (when accessible), effectively grounded metal water pipe, or other approved electrodes when the former are not available. Neutral and ground conductors on the secondary side of the transformer shall be bonded at the transformer only, not at the overcurrent protection point. Provide bond jumper sized per NEC Table 250-66.

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 - 4. Coordinate subparagraph below with "Informational Submittals" Article; revise to suit Project.
 - 5. Prepare dimensioned Drawings locating ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- B. Grounding system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.
- D. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - 2. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).

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- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 16452

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SECTION 16511 - INTERIOR LIGHTING

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 work of this Section.
- B. Division 16 Basic Electrical Materials and Methods sections apply to work specified in this section.

1.2 SUMMARY

- A. Extent, location, and details of interior lighting fixture work are indicated on drawings and in schedules.
- B. Section Includes:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature.
- C. CRI: Color-rendering index.
- D. HID: High-intensity discharge.
- E. LED: Light-emitting diode
- F. LER: Luminaire efficacy rating.
- G. Lumen: Measured output of lamp and luminaire, or both.
- H. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

- A. General: Submit each item in this section in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

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1. Physical description of lighting fixture including dimensions.
 2. Emergency lighting units including battery and charger.
 3. Ballast, including BF.
 4. Energy-efficiency data.
 5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project. LED fixtures shall also be tested per IES LM-79 and IES LM-80.
 - a. Certified fixtures, as noted on schedule, by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
 - b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- C. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Wiring Diagrams: For power, signal, and control wiring.
- D. Provide samples of fixtures to the designer as requested.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of interior lighting fixtures of sizes, types and ratings required, whose products are UL listed and/or labeled.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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- D. Comply with NFPA 70.
- E. Electrical Code Compliance: Comply with applicable State code requirements of the authority having jurisdiction.
- F. UL Compliance: Comply with UL standards, including UL 486A and B, pertaining to interior lighting fixtures. Provide interior lighting fixtures and components which are UL listed and labeled.
- G. CBM Labels: Provide fluorescent lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.
- H. Each LED fixture type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.8 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.
- B. Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of interior lighting fixtures with other work.
- C. Sequence interior lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

1.9 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
- B. Special Warranty for LED: LED fixtures shall have a five year full replacement warranty.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver interior lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from damage.
- B. Store interior lighting fixtures in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, laid flat and blocked off ground.
- C. Handle interior lighting fixtures carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings. All fixtures of the same type shall be of one manufacturer.
- B. All lamps shall be GE, Philips or Osram Sylvania.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 6 as applicable.
- D. LED Fixtures: Comply with UL 1598 and UL 8750. Where LER is specified, test according to NEMA LE 6 as applicable.
- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Steel unless otherwise indicated. Components used in MRI Exam Room shall be of nonmagnetic materials. Form and support to prevent warping and sagging.
- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- H. Diffusers and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
- I. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp and ballast characteristics:
 - a. "USE ONLY" and include specific lamp type.

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- b. Lamp diameter code (T-4, T-5, T-8, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
 - c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
 - d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
 - e. CCT and CRI for all luminaires.
- J. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.
- K. Lighting Fixtures Recessed in Fire Rated Ceilings, and Plenum Spaces:
- 1. Fixture shall be constructed to provide continuous operation when installed in air plenums, or when surrounded with restrictive enclosures of fire-rated construction. See architectural ceiling schedule.
 - 2. Where space above ceiling is used as an air plenum for return air ventilation arrangements, the fixture shall be factory wired in accordance with Article 300-22 of the NEC and U.L. approved for use in air plenums. Coordinate with Division 26 work.
- L. Ballast Access:
- 1. Ballasted fixtures recessed in ceiling systems shall be capable of ballast removal through the aperture.
- M. LED fixtures shall have integral drivers.
- N. LED drivers for fixtures indicated to be dimmed, step-dimmed or fully dimmed, shall have the LED drivers and the dimmers matched to provide the performance indicated on the drawings.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. General Requirements for Electronic Ballasts:
- 1. Comply with UL 935 and with ANSI C82.11.
 - 2. Designed for type and quantity of lamps served.
 - 3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
 - 4. Sound Rating: Class A.
 - 5. Total Harmonic Distortion Rating: Less than 10 percent.
 - 6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 - 7. Operating Frequency: 42 kHz or higher.
 - 8. Lamp Current Crest Factor: 1.7 or less.
 - 9. BF: 0.88 or higher.
 - 10. Power Factor: 0.98 or higher.
 - 11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
- B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.
- C. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:
- 1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.

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2. Automatic lamp starting after lamp replacement.
- D. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.
- E. Ballasts for Low-Temperature Environments:
- F. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.
- G. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
 1. Dimming Range: 100 to 5 percent of rated lamp lumens.
 2. Ballast Input Watts: Can be reduced to 20 percent of normal.
 3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
 4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

- A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer control is indicated:
 1. Lamp end-of-life detection and shutdown circuit.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: Class A.
 4. Total Harmonic Distortion Rating: Less than 10 percent.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. BF: 0.95 or higher unless otherwise indicated.
 9. Power Factor: 0.98 or higher.
 10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 DIMMING BALLASTS

1. Electronic dimming ballast shall provide continuous flicker-free dimming throughout the specified dimming range. Range shall be 100% to 5% if not specified otherwise.
2. Electronic dimming ballast shall have a power factor greater than .95.
3. Electronic dimming ballast shall have a lamp current crest factor (CCF) less than or equal to 1.7 as specified in ANSI C82.11.
4. Electronic dimming ballast shall have internal circuitry to limit inrush current to a maximum of seven amps at 120 volts, three amps at 277 volts.
5. Electronic dimming ballast shall be a programmed rapid start type and preheat lamp cathodes before applying full arc voltage to ensure average rated lamp life is not diminished.
6. Electronic dimming ballast operation shall not diminish average rated lamp life.
7. Electronic dimming ballast shall provide end-of-lamp-life protection for T5 linear and T4 4-pin lamps.

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8. Electronic dimming ballast shall be capable of striking lamps at any light level without first flashing to full light.
9. Electronic dimming ballast shall meet FCC Part 18 Non-Consumer Specifications for EMI/RFI emissions
10. Electronic dimming ballast shall meet ANSI C62.41 Category A transient voltage line protection requirements up to and including 6KV.
11. Electronic dimming ballast shall have a continuous flicker-free architectural dimming range of 100% -1% relative light output (RLO) for T5, T8, and T12 linear fluorescent lamps and T4 4-pin compact fluorescent lamps.
12. Electronic dimming ballast shall be specified Lutron Hi-lume1% or approved equal.

2.6 EMERGENCY FLUORESCENT POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
 1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Nightlight Connection: Operate one fluorescent lamp continuously.
 3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 6. Verify required input voltage of all components with voltages of circuits supplying fixtures as shown on the Drawings, prior to ordering.
 7. Lighting output shall be 1350 lumens for a T8 32w lamp.
 8. Illumination time shall be 90 minutes, minimum.
 9. Operational ambient temperature shall be 32 – 131 degrees F.
 10. Ballast shall be Bodine B50 or approved equal.
 11. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.7 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction. Provide self-powered battery type or non-battery type as called for on the drawings.
- B. Internally Lighted Signs:
 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.

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- c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
- e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
- f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is announced by an integral audible alarm and a flashing red LED.

2.8 EMERGENCY LIGHTING UNITS

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 6. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
 - 7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is announced by an integral audible alarm and a flashing red LED.

2.9 FLUORESCENT LAMPS

- A. All lamps shall be GE, Philips or Osram Sylvania.
- B. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 4100 K, and average rated life 20,000 hours unless otherwise indicated.
- C. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 4100 K, and average rated life of 20,000 hours unless otherwise indicated.
- D. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches (1150 mm), 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 4100 K, and average rated life of 20,000 hours unless otherwise indicated.
- E. T5HO rapid-start, high-output lamps, rated 54 W maximum, nominal length of 45.2 inches (1150 mm), 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 4100 K, and average rated life of 20,000 hours unless otherwise indicated.

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- F. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 4100 K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts unless otherwise indicated.
1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
 6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
 7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.10 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- B. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- D. Rod Hangers: 1/4-inch (6.35-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- F. Factory mounting bars: Provide factory mounting bars for all recessed downlights installed in lay in ceilings that will support the fixture from the ceiling tee bars.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures:
1. Install interior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 2. Install lamps in each luminaire.
- B. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- C. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
1. Install ceiling support system rods or wires, independent of the ceiling suspension system, for each fixture. Provide a fixture support wire from each corner of the fixture to the structural deck above.

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2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch factory provided metal channels spanning and secured to ceiling tees.
- D. Recessed Downlight Supports:
1. Each recessed down light shall be furnished with factory supplied T-bar hangers to attach the fixture to the ceiling grid system,
 2. Provide a fixture support wire, independent of the ceiling system, from the fixture to the structural deck.
- E. Fasten fixtures securely to indicated structural supports; and ensure that pendant fixtures are plumb and level. Provide individually mounted pendant fixtures longer than two (2') feet with twin stem hangers. Provide stem hanger with ball aligners and provisions for minimum one (1") inch vertical adjustment.
- F. Mount continuous rows of fixtures with an additional stem hanger greater than number of fixtures in the row.
- G. Connect wiring according to other Division 16 sections.
- H. Provide fixtures and/or fixture outlet boxes with hangers to properly support fixture weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by Engineer.
- I. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surfaces.
- J. Provide plaster frames for recessed fixtures installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.
- K. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code.
- L. Support surface mounted fixtures greater than two (2') feet in length at one other point in addition to the outlet box fixture stud.
- M. Surface mounted fluorescent fixtures shall be mounted using 1/4" threaded rod at each end and rods shall be attached to the building structure above the ceiling. Ceiling grid tees shall not be used for supporting surface mounted fixtures.
- N. Do not use fixture as raceway. Provide factory mounting bars to suspend all recessed downlights installed in lay in ceilings that will support the fixture from the ceiling tee bars.

3.2 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in "Electrical Identification."

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3.3 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.
- C. Replace defective fixtures and components and burned out lamps for a period of one year following the Date of Substantial Completion.
- D. At Date of Substantial Completion, replace lamps in interior lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Engineer.

3.4 GROUNDING

- A. Provide equipment grounding connections for interior lighting fixtures as indicated and as specified in Grounding.
- B. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

3.5 STARTUP SERVICE

- A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.6 ADJUSTING AND CLEANING

- A. Clean interior and exterior lighting fixtures of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses.
- B. Protect installed fixtures from damage during remainder of construction period.

3.7 DEMONSTRATION

- A. Upon completion of installation of interior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements.
- B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 16511

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