



CITY OF GREENVILLE

**RECREATION AND PARKS
AQUATICS AND FITNESS CENTER
FAMILY RESTROOM ADDITION**

Greenville, NC 27858

PROJECT MANUAL

TEG PROJECT NO. 20210180

**Issue for Construction
November 9, 2021**



**324 Evans Street
Greenville, NC 27858
Tel (252) 758-3746
Fax (252) 830-3954
www.eastgroup.com**

**NC Engineering License No. C-0206
NC Architectural License No. 50213**

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Company



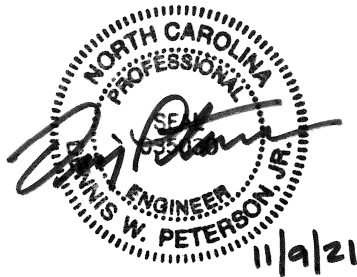
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Architectural



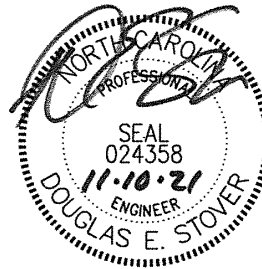
Procopio Serrano, AIA
NC License No. 13124

Fire Protection, Plumbing & Mechanical



Dennis W. Peterson, Jr., PE
NC License No. 035030

Electrical



Douglas E. Stover, PE
NC License No. 024358

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RECREATION AND PARKS
AQUATICS AND FITNESS CENTER FAMILY RESTROOM ADDITION**

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SECTION 00100 - INVITATION TO BID

Sealed proposals will be received by The City of Greenville up until 2:00 PM, December 14th 2021, in Jaycee Park Administration Building, 2000 Cedar Lane, Greenville NC 27835 for furnishing all labor, materials and equipment entering into the construction of the **Aquatics and Fitness Center Family Restroom Addition** in accordance with the documents prepared by The East Group, PA.

The bids will be publicly opened after 2:00PM on the date of the bid.

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

A Pre-Bid Conference will be held at 2:00 PM, November 30th 2021, in the Greenville Aquatics and Fitness Center, 921 Stanton Road, Greenville, NC. A mandatory site visit is required for this project immediately after the pre-bid on November 30th 2021 or as agreed and scheduled times by the owner at the pre-bid.

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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**CITY OF GREENVILLE
RECREATION AND PARKS
AQUATICS AND FITNESS CENTER FAMILY RESTROOM ADDITION**

Advertisement for Bids

Sealed bids will be received by The City of Greenville until 2:00 PM for Single Prime Bids, December 14th 2021, at Jaycee Park Administration Building, 2000 Cedar Lane, Greenville, NC. The bids will, immediately thereafter, be publicly opened and read aloud for furnishing all labor, materials and equipment entering into the construction of the

**City of Greenville Recreation and Parks, Aquatics And Fitness Center Family Restroom
Addition**

GREENVILLE, NORTH CAROLINA

A Pre-Bid Conference will be held at 2:00 PM, November 30th 2021, in the Greenville Aquatics and Fitness Center, 921 Stanton Road, Greenville, NC. A mandatory site visit is required for this project.

All times are Eastern Daylight Savings time

Lump sum proposals will be received for the following:

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

Digital Complete Plans, Specifications and Contract Documents will be available free from the **City of Greenville's Website** and at McGee Cadd, 2095 Evans St. Greenville, NC 27834 (252-752-4400).

All questions regarding plans are to be referred to the architect of record, Procopio Serrano, AIA of the East Group, via **email or fax** at procopio.serrano@eastgroup.com and/or 252-830-3954 (fax).

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 a new water service to new main shut off valve inside building. It also includes the installation of distribution piping and valves from main shut off valve to new and existing fixtures and equipment to replace existing distribution piping that will be left abandoned in place.

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 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.

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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: Angelina Brinkley,
Purchasing Manager
City of Greenville
aebrinkley@greenvillenc.gov
252-329-4862

CITY OF GREENVILLE MBE/WBE PLAN

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%

CITY OF GREENVILLE MBE/WBE PLAN

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
RECREATION AND PARKS
AQUATICS AND FITNESS CENTER FAMILY RESTROOM ADDITION**

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.
- C. Email DCR form to Dennis Peterson at dennis.peterson@eastgroup.com.

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
RECREATION AND PARKS
AQUATICS AND FITNESS CENTER FAMILY RESTROOM ADDITION**

00215 – DOCUMENT CLARIFICATION REQUEST (DCR)

DOCUMENT CLARIFICATION REQUEST	
Date: _____	
Attention: Procopio Serrano The East Group, PA 324 Evans Street Greenville NC 27835	Submitted By: _____
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
RECREATION AND PARKS
AQUATICS AND FITNESS CENTER FAMILY RESTROOM ADDITION**

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
RECREATION AND PARKS
AQUATICS AND FITNESS CENTER FAMILY RESTROOM ADDITION**

BID FORM

TO: **City of Greenville, Recreation and Parks**
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
Recreation and Parks
Aquatics and Fitness Center Family Restroom Addition
Greenville, North Carolina**

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: _____

	Amount	<u>Duration (days)</u>
BASE BID	(\$ _____)	_____

All general, electrical, plumbing and mechanical demolition and new work associated with providing a new family shower room 101.

	Amount	<u>Duration (days)</u>
ADD ALTERNATE-1	(\$ _____)	_____

All general, electrical, plumbing and mechanical demolition and new work associated with providing a new family shower room 104.

LIST OF SUBCONTRACTORS			
	NAME OF COMPANY/ADDRESS		BID
PLUMBING			
Electrical			

**CITY OF GREENVILLE
RECREATION AND PARKS
AQUATICS AND FITNESS CENTER FAMILY RESTROOM ADDITION**

ATTACH CHECK, CASH OR BID BOND TO THIS PROPOSAL.

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.

Consecutive Calendar Days Provided in the Bid (not to exceed 90 for both base bid and alternate combined).

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 **(\$500.00)** 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
RECREATION AND PARKS
AQUATICS AND FITNESS CENTER FAMILY RESTROOM ADDITION**

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
RECREATION AND PARKS
AQUATICS AND FITNESS CENTER FAMILY RESTROOM ADDITION**

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
RECREATION AND PARKS
AQUATICS AND FITNESS CENTER FAMILY RESTROOM ADDITION**

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; will need to provide documentation of similar projects in scope, scale and cost)

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 2019

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.

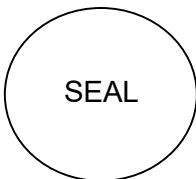
The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority/Women Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d)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

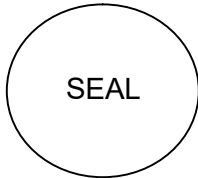
The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement.

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**)

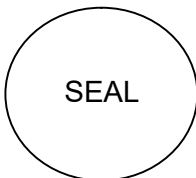
Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with MWBE Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

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.

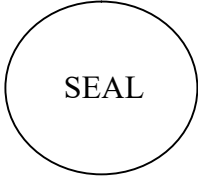
Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with MWBE Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

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.

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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LOCAL PREFERENCE POLICY

The City of Greenville has adopted a Local Preference Policy, Resolution No. 056-13, and a Professional and other Services Policy, Resolution No. 057-13 that will pertain to this project. For more information, please see the City of Greenville's webpage at www.greenvillenc.gov/financialservices/purchasingdivision.

E-VERIFY COMPLIANCE

The Contractor shall comply with the requirements of Article 2 of Chapter 64 of the North Carolina General Statutes. Further, if the Contractor utilizes a Subcontractor, the Contractor shall require the Subcontractor to comply with the requirements of Article 2 of Chapter 64 of the North Carolina General Statutes. By submitting a proposal, The Proposer represents that their firm and its Subcontractors are in compliance with the requirements of Article 2 Chapter 64 of the North Carolina General Statutes.

IRAN DIVESTMENT ACT

Vendor certifies that; (i) it is not on the Iran Final Divestment List created by the North Carolina State Treasurer pursuant to N.C.G.S. 143-86.58; (ii) it will not take any actions causing it to appear on said list during the terms of this Purchase Order, and (iii) it will not utilize any subcontractor to provide goods and services hereunder that is identified on said list.

All firms that are submitting a bid are required to complete the Iran Divestment Act Certification form included and shall be included with the bid package. Failure to include the form may deem the bid unresponsive.

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**CITY OF GREENVILLE
RECREATION AND PARKS
AQUATICS AND FITNESS CENTER FAMILY RESTROOM ADDITION**

**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. North Carolina AIA
115 W. Morgan Street
Raleigh, NC 27601
3. The East Group Architecture, P.A.
P.O. Box 7305
Greenville, NC 27835-07305**A.I.A.**

**CITY OF GREENVILLE
RECREATION AND PARKS
AQUATICS AND FITNESS CENTER FAMILY RESTROOM ADDITION**

**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
2. North Carolina AIA
115 W. Morgan Street
Raleigh, NC 27601
3. The East Group Architecture, P.A.
P.O. Box 7305
Greenville, NC 27835-07305

**CITY OF GREENVILLE
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AQUATICS AND FITNESS CENTER FAMILY RESTROOM ADDITION**

**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
1735 New York Ave., N.W.
Washington, D.C. 20006
2. North Carolina AIA
115 W. Morgan Street
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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. North Carolina AIA
115 W. Morgan Street
Raleigh, NC 27601
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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.
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2. North Carolina AIA
115 W. Morgan Street
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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 covered by such subcontract.”

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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 %."

ARTICLE 8 TIME

8.3 DELAYS AND EXTENSIONS OF TIME

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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
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

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\$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.”

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”.

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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 01110 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SCOPE OF WORK

The project involves installation of two new family shower rooms.

1.2 SINGLE PRIME CONTRACT

A. These documents form the Contract Documents for the Contract with the Owner as follows:

1. The Agreement;
2. The Addenda;
3. The General Conditions of the Contract;
4. Technical Specifications Divisions One thru 16;
5. Drawings;
 - a) Cover Sheet;
 - b) T series sheets;
 - c) A series sheets;
 - d) P series sheets;
 - e) M series sheets;
 - f) E series sheets;

1.3 CONSTRUCTION SEQUENCE

- A. It is recognized that this project will tend to disrupt operations of the existing facility; however, certain vital operations and services now in the construction area cannot be terminated or disrupted. Therefore, relocation of these operations and services must be accomplished in a certain planned sequence so as to allow continuous operation of these services.
- B. The following description explains these steps and this sequence must be adhered to by all Contractors.

1.4 PHASING PLAN

The Work for this project is to be completed in 2 phases. Work for new doors into existing locker and shower rooms will be done parallel to the work on phase 1. Work on family rooms will be final phase 2. See phasing plans. Specific sequence of work and laydown area needs to be coordinated with the Owner. The Owner is to have final approval of the scheduled work tasks so as to minimize the disruption caused by the construction of this project to the ongoing operations of the Aquatics and Fitness Center; note normal operating hours are from 5:30am to 8pm.

1.5 CONTRACTOR'S USE OF PREMISES

A. General:

1. Confine operations to areas within Contract limits indicated. Portions of the site beyond these limits shall not be disturbed.

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- B. Keep driveways and entrances serving the premises clear and available to the Owner at all times.
- C. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
- D. Maintain the existing building in a weather tight condition throughout the construction period. Repair damage caused by construction operations immediately. Take all precautions necessary to protect the building and its occupants during the construction period.

1.6 OWNER OCCUPANCY:

- A. Full Owner Occupancy:
 - 1. The Owner will occupy the site and existing building during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Schedule and perform the Work so as not to interfere with the Owner's operations.
- B. A Certificate of Substantial Completion will be executed for each specific phase of the Work. Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.
- C. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been completed. Upon partial occupancy the Owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.

1.7 OWNER-FURNISHED ITEMS

- A. The Contractor is responsible for designating the delivery dates of Owner-furnished items in the Contractor's Construction Schedule and for receiving, unloading and handling Owner-furnished items at the site. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to the elements, and to repair or replace items damaged as a result of his operations. The Contractor is responsible for installation of these items unless otherwise indicated.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

END OF SECTION 01110

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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.

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PART 2 - PRODUCTS (Not Used)**

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

Alternate No.1 All general, electrical, plumbing and mechanical demolition and new work associated with providing a new family shower room 104.

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.
- B. See Division 1 Section "Allowances" for procedural requirements for handling and processing allowances.
- C. See Division 1 Section "Unit Prices" for administrative requirements for using unit prices.

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.

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2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include 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 ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
1. Include installation costs in purchase amount only where indicated as part of the allowance.
 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed.

1.5 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.

1.6 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.

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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 01270 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for unit prices.
- B. See Division 1 Section "Allowances" for procedures for using unit prices to adjust quantity allowances.

1.2 DEFINITIONS

- A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not used)

END OF SECTION 01270

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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.
 3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of 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. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
 7. 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.

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- 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.
- 8. 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:

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1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's Construction Schedule (preliminary if not final).
 4. Submittals Schedule (preliminary if not final).
 5. Certificates of insurance and insurance policies 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. Preinstallation Conferences: Conduct a preinstallation 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.

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- 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.

- 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.
- 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 21 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: Place a permanent label or title block on each submittal for identification.
 - 1. Indicate name of firm or entity that prepared each submittal on label or title block.

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2. Provide a space approximately **4 by 5 inches (100 by 125 mm)** on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label 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. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal (preferably digital in pdf format) may serve as final submittal.
- G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
 1. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Use only final submittals 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 or unless a digital copy cannot be processed then provide three copies of each submittal by exception, unless otherwise indicated. Architect will return a digital copy via email. Mark up and retain one returned copy as a Project Record Document.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:

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- 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.
 - 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.
 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least **8-1/2 by 11 inches (215 by 280 mm)** but no larger than **30 by 40 inches (750 by 1000 mm)**.
- D. Samples: 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.

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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.
- 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, or two copies of each submittal (if a digital copy cannot be processed), unless otherwise indicated. Architect will not return copies.
 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. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
- G. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- H. 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.
- I. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by

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manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

- J. 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."
- K. 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.
- L. 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.
- M. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections.
- N. 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. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged.
- D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.3 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.4 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.

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- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.
- C. 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.
 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.
- D. 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.

1.5 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. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

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- F. 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.
- G. 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.
- H. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Demolish and remove mockups when directed.

1.6 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 reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- 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.

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- 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/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, 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

- 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

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(Formerly: FM - Factory Mutual System)

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

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(Formerly: ALA - American Laminators Association)

LPI	Lightning Protection Institute
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

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NFRC	National Fenestration Rating Council
NGA	National Glass Association
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

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SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPFA	Spray Polyurethane Foam Alliance (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.
WASTEC	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)

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WIC	Woodwork Institute of California
WMMPA	Wood Moulding & Millwork Producers Association
WWPA	Western Wood Products Association

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

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PBS Public Building Service (See GSA)
RUS Rural Utilities Service (See USDA)
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 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.3 USE CHARGES

- A. General: Installation and installation costs of temporary electrical service and facilities shall be by electrical contractor. Installation and installation costs of heating and cooling facilities shall be by Mechanical Contractor. All other 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.

1.4 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.

1.5 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.

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- 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.

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. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.
- F. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- G. 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

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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

- A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- B. Sewers and Drainage:
 - 1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 - 2. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
- C. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
 - 1. Provide rubber hoses as necessary to serve Project site.
 - 2. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
- D. 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.
 - 2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.
 - 3. Drinking-Water Facilities: Provide bottled-water, drinking-water units.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from

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adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.

1. Maintain a minimum temperature of **50 deg F (10 deg C)** in permanently enclosed portions of building for normal construction activities, and **65 deg F (18.3 deg C)** for finishing activities and areas where finished Work has been installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
1. Install power distribution wiring overhead and rise vertically where least exposed to damage.
- H. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 2. Provide one 100-W incandescent lamp per **500 sq. ft. (45 sq. m)**, uniformly distributed, for general lighting, or equivalent illumination.
 3. Provide one 100-W incandescent lamp every **50 feet (15 m)** in traffic areas.
 4. Provide one 100-W incandescent lamp per story in stairways and ladder runs, located to illuminate each landing and flight.
 5. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.
- J. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities. Install separate telephone line for each field office and first-aid station.
1. Provide additional telephone lines for the following:
 - a. In field office with more than two occupants, install a telephone for each additional occupant or pair of occupants.
 - b. Provide a dedicated telephone line for each facsimile machine and computer with modem in each field office.
 2. At each telephone, post a list of important telephone numbers, including police and fire departments ambulance service Contractor's home office Architect's office Engineers' offices Owner's office and principal subcontractors' field and home offices.
 3. Provide voice-mail service on superintendent's telephone.

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4. Provide a portable cellular telephone for superintendent's use in making and receiving telephone calls when away from field office.

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. Provide incombustible construction for offices, shops, and sheds located within construction area or within **30 feet (9 m)** of building lines. Comply with NFPA 241.
3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
4. of final course according to Division 2 Section "Hot-Mix Asphalt Paving ."
5. Prepare temporary signs to provide directional information to construction personnel and visitors.

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. Common-Use Field Office: Provide an insulated, weathertight, heated and air-conditioned field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings of 10 persons at Project site. Keep office clean and orderly.

D. 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. Stormwater Control: Provide storm water and erosion control measures indicated on drawings.

C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning

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signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

- E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 - 2. Vertical Openings: Close openings of 25 sq. ft. (2.3 sq. m) or less with plywood or similar materials.
 - 3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
 - 4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.

- F. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
 - 1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
 - a. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
 - 4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
 - 5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
 - 6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

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- C. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

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

- 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.

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1. Substitution Request Form: Use CSI Form 13.1A .
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.
 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.

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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. Timing: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 2. Requested substitution does not require extensive revisions to the Contract Documents.
 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 4. Substitution request is fully documented and properly submitted.
 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Work.
 8. Requested substitution has been coordinated with other portions of the Work.
 9. Requested substitution provides specified warranty.

2.3 COMPARABLE PRODUCTS

- A. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:
 1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.

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.

1.2 SUBMITTALS

A. Substitution Request Submittal:

1. Submit 3 copies 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 it 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: _____

General Contractor

Date

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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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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 sitework, 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 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 3. Inform installers of lines and levels to which they must comply.
 4. Check the location, level and plumb, of every major element as the Work progresses.

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5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- 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.
- 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.

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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.

3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

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- I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.8 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.

3.9 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. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. 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. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. 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.
 - 2. Demolition and removal of selected site elements.
- B. See Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.

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

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. 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.

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- 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.

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 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

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3.3 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.

3.4 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:
 - 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.

3.5 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.

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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.

3.6 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. Reinspection: Request reinspection 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies 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 suitable sets of manageable size. Bind and index data in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of 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.
 - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive **8-1/2-by-11-inch (115-by-280-mm)** paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

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 adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 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.

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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.
 - 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. Sweep concrete floors broom-clean in unoccupied spaces.
 - h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - j. Remove labels that are not permanent.
 - k. 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.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - l. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Replace parts subject to unusual operating conditions.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

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- q. Leave Project clean and ready for occupancy.

- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

- D. 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:

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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 manufacturer. Organize the warranty documents into an orderly sequence based on the Table of Contents of the Project Manual. 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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SECTION 03300 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings and Piers.
 - 2. Slabs-on-grade.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: Fly ash and other pozzolans; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Cold-weather/Hot-weather Concrete Placement Procedure Plan: Indicate steps and procedures to be undertaken during concrete placements during cold and hot weather conditions.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.
- F. Qualification Data: For Installer.
- G. Material Certificates: For each of the following, signed by manufacturers:

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1. Cementitious materials.
 2. Admixtures.
 3. Form materials and form-release agents.
 4. Steel reinforcement and accessories.
 5. Curing compounds.
 6. Floor and slab treatments.
 7. Bonding agents.
 8. Adhesives.
 9. Vapor retarders.
 10. Semirigid joint filler.
 11. Joint-filler strips.
 12. Repair materials.
- H. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Aggregates.
- I. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- J. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer with a successful record of a minimum of five (5) years of projects completed in similar size, construction type and scope as this project.
1. An installer who employs personnel qualified as ACI-certified Flatwork Technician and Finisher and an on site supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Mix Design Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
1. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

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1. ACI 301, "Specifications for Structural Concrete"
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
3. ACI 318, "Building Code Requirements for Structural Concrete."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, **3/4 by 3/4 inch (19 by 19 mm)**, minimum.

E. 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.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than **1 inch (25 mm)** to the plane of exposed concrete surface.

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2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- C. Plain-Steel Wire: ASTM A 82 as drawn.
- D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F.
- B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 5 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94, potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.

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B. Chemical Admixtures: Use of admixtures is at the contractor's discretion. When used provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
- b. BASF Construction Chemicals - Building Systems; Confilm.
- c. ChemMasters; SprayFilm.
- d. Conspec by Dayton Superior; Aquafilm.
- e. Dayton Superior Corporation; Sure Film (J-74).
- f. Edoco by Dayton Superior; BurkeFilm.
- g. Euclid Chemical Company (The), an RPM company; Eucobar.
- h. Kaufman Products, Inc.; Vapor-Aid.
- i. Lambert Corporation; LAMBCO Skin.
- j. L&M Construction Chemicals, Inc.; E-CON.
- k. Meadows, W. R., Inc.; EVAPRE.
- l. Metalcrete Industries; Waterhold.
- m. Nox-Crete Products Group; MONOFILM.
- n. Sika Corporation; SikaFilm.
- o. SpecChem, LLC; Spec Film.
- p. Symons by Dayton Superior; Finishing Aid.
- q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
- r. Unitex; PRO-FILM.
- s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A certified by curing and sealing compound manufacturer to not interfere with bonding of floor covering.

1. Products: Subject to compliance with requirements, provide one of the following:

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- a. BASF Construction Chemicals - Building Systems; Kure 1315.
- b. ChemMasters; Polyseal WB.
- c. Conspec by Dayton Superior; Sealcure 1315 WB.
- d. Edoco by Dayton Superior; Cureseal 1315 WB.
- e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
- f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
- g. Lambert Corporation; UV Safe Seal.
- h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
- i. Meadows, W. R., Inc.; Vocomp-30.
- j. Metalcrete Industries; Metcure 30.
- k. Right Pointe; Right Sheen WB30.
- l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
- m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

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2.10 CONCRETE MIXTURES, GENERAL

- 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.
 - 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.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. 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).
- B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 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).

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2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
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.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Provide 3/4 inch chamfer at all exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

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- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

- A. Granular Course: Cover subgrade with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
- B. Sheet Vapor Retarders: Cover granular course with sheet vapor retarder. Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

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3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced at a maximum of 48 inches on center in each direction to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for slabs on metal deck as indicated on drawings.
 - 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 6. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- C. Control Joints in Slabs-on-Grade: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. 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 slab is eight hours old.

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- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect unless water is held back at plant and amount of held back water is printed on the batch ticket, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. 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

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temperatures. Contractor will submit cold-weather concrete placement plan that will be used to undertake cold-weather concrete placement techniques when required.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 305 and as follows. Contractor will submit hot-weather concrete placement plan that will be used to undertake hot-weather concrete placement techniques when required.
1. Maintain concrete temperature below 90 deg F at time of placement.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

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3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 - 1. Apply scratch finish to surfaces indicated, to receive concrete floor toppings, and to receive mortar setting beds for bonded cementitious floor finishes.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces indicated, exposed to view, to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. For Slabs on Grade: Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15.
 - b. Overall values of flatness and levelness are to be determined for each individual area of concrete placed at one time.
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated and where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
 - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

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3.11 CONCRETE PROTECTING 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 ACI 305 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including basement walls, underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period additional curing is at contractor's option. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Use moisture-retaining covers to cure concrete slab surfaces. Moisture-retaining covers by be used to cure all other concrete at contractor's option.
 - 2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Cure concrete other than concrete slab surfaces with a curing compound at the contractor's option.
 - 3. Curing and Sealing Compound: Apply uniformly to floors and slabs only where indicated in a 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

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- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around.

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Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain composite sample(s) for each day's pour of each concrete mixture exceeding 5 cu. yd per the following:

Concrete Delivered	Composite Samples Obtained
Less than 5 cubic yards	None
5 cubic yards to 49 cubic yards	1 (take from first load delivered)
50 cubic yards to 100 cubic yards	1
Over 100 cubic yards	1 for each 100 cubic yards or fraction thereof

- a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143; one test at point of placement (back of concrete truck) prior to conveyance by pump, bucket, etc. for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

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3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173 volumetric method, for structural lightweight concrete; one test at point of placement (back of concrete truck) prior to conveyance by pump, bucket, etc. for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test at point of placement (back of concrete truck) prior to conveyance by pump, bucket, etc. for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 6. Compression Test Specimens: ASTM C 31.
 - a. Cast and laboratory cure five, 6 inch by 12 inch (or seven 4 inch by 8 inch) standard cylinder specimens for each composite sample.
 7. Compressive-Strength Tests: ASTM C 39; test one 6 by 12 inch (or one 4 by 8) laboratory-cured specimen at 7 days and two 6 by 12 (or three 4 by 8 inch) laboratory-cured specimens at 28 days and hold two 6 by 12 (or three 4 by 8 inch) laboratory-cured specimens in reserve for 56 day test if required.
 - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- C. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION 03300

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SECTION 04810 - UNIT MASONRY ASSEMBLIES

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. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Steel reinforcing bars.
 - 4. Masonry joint reinforcement.
 - 5. Ties and anchors.
 - 6. Embedded flashing.
 - 7. Miscellaneous masonry accessories.
 - 8. Masonry-cell insulation.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
 - 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

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- C. Qualification Data: For Installer.
- D. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Grout mixes. Include description of type and proportions of ingredients.
 - 5. Reinforcing bars.
 - 6. Joint reinforcement.
 - 7. Anchors, ties, and metal accessories.
- E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
- F. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- G. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- D. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01400 "Quality Requirements" for mockups.
 - 1. Build sample panels for typical exterior and interior walls in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

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- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of **24 inches (600 mm)** down both sides of walls and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is **40 deg F (4 deg C)** and higher and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

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PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.3 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.4 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.

2.5 COLORS, TEXTURES, AND PATTERNS

- A. Exposed Masonry Units: Match sample.

2.6 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.

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1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **1900 psi (13.1 MPa)**.

2.7 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.

2.8 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, **Grade 60 (Grade 420)**.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from **0.148-inch (3.77-mm)** steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
 1. Interior Walls: Hot-dip galvanized carbon steel.
 2. Exterior Walls: Hot-dip galvanized carbon steel.
 3. Wire Size for Side Rods: **0.148-inch (3.77-mm)** diameter.
 4. Wire Size for Cross Rods: **0.148-inch (3.77-mm)** diameter.
 5. Wire Size for Veneer Ties: **0.148-inch (3.77-mm)** diameter.
 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than **16 inches (407 mm)** o.c.
 7. Provide in lengths of not less than **10 feet (3 m)**, with prefabricated corner and tee units.
- D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.
- E. Masonry-Joint Reinforcement for Multiwythe Masonry:

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1. Ladder type with one side rod at each face shell of hollow masonry units more than **4 inches (100 mm)** wide, plus one side rod at each wythe of masonry **4 inches (100 mm)** wide or less.

2.9 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 Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped **1/4-inch- (6.35-mm-)** diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
2. Tie Section: Triangular-shaped wire tie made from **0.187-inch- (4.76-mm-)** diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

D. 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:
 - 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 designed to retain the 2" rigid cavity insulation & transfer loads directly to the steel studs Dur-o-wall DA213, POS-I-TIE by Heckman, or x-seal 315 by Hohmann & Barnard.
 - a. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from **0.188-inch- (4.8-mm-)** diameter, hot-dip galvanized steel wire.

2.10 EMBEDDED FLASHING MATERIALS

- A. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

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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) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
- 2) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier-44.
- 3) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
- 4) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
- 5) Hohmann & Barnard, Inc.; Textroflash.
- 6) Polyguard Products, Inc.; Polyguard 300.
- 7) Polytite Manufacturing Corp.; Poly-Barrier Self-Adhering Wall Flashing.
- 8) 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.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

- A. Weep/Vent Products: Use the following, unless otherwise indicated:

1. Wicking Material: Absorbent rope, made from 100% cotton, 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity. Use only for weeps.

2.12 INSULATION

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

2.13 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.

2.14 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, unless otherwise indicated.

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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.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than **2000 psi (14 MPa)**.
 3. Provide grout with a slump of **8 to 11 inches (200 to 280 mm)** as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, 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.
- D. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
- E. 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.
- F. 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.

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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 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus **1/2 inch (12 mm)** or minus **1/4 inch (6 mm)**.
2. For location of elements in plan do not vary from that indicated by more than plus or minus **1/2 inch (12 mm)**.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus **1/4 inch (6 mm)** in a story height or **1/2 inch (12 mm)** total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than **1/4 inch in 10 feet (6 mm in 3 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. For vertical lines and surfaces do not vary from plumb by more than **1/4 inch in 10 feet (6 mm in 3 m)**, **3/8 inch in 20 feet (9 mm in 6 m)**, or **1/2 inch (12 mm)** maximum.
4. 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.
5. For lines and surfaces do not vary from straight by more than **1/4 inch in 10 feet (6 mm in 3 m)**, **3/8 inch in 20 feet (9 mm in 6 m)**, or **1/2 inch (12 mm)** maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than **1/4 inch in 10 feet (6 mm in 3 m)**, or **1/2 inch (12 mm)** maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3 mm)**, with a maximum thickness limited to **1/2 inch (12 mm)**.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than **1/8 inch (3 mm)**.
3. For head and collar joints, do not vary from thickness indicated by more than plus **3/8 inch (9 mm)** or minus **1/4 inch (6 mm)**.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3 mm)**.

3.3 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.

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- 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. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than **4-inches (100-mm)**. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- 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.

3.5 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached and seismic anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.

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2. Embed tie sections connector sections and continuous wire in masonry joints.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 4. Space anchors as indicated, but not more than **16 inches (406 mm)** o.c. vertically and **25 inches (635 mm)** o.c. horizontally, with not less than one 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.
- B. Provide not less than space indicated on drawings for airspace between back of masonry veneer and face of insulation.
1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
1. Space reinforcement not more than 16 inches (406 mm) o.c.
 2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
 2. Install preformed control-joint gaskets designed to fit standard sash block.

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3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
 4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick as follows:
1. Build flanges of metal expansion strips into masonry. Lap each joint **4 inches (100 mm)** in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
 3. Build in compressible joint fillers where indicated.
 4. Form open joint full depth of brick wythe and of width indicated, but not less than **3/8 inch (10 mm)** for installation of sealant and backer rod specified in Section 07920 "Joint Sealants."
- D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07920 "Joint Sealants," but not less than **3/8 inch (10 mm)**.

Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry

3.8 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.9 FLASHING

- A. General: Install embedded flashing in masonry at 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 with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. At lintels, 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. Ensure "Through Wall" flashing extends through wall.
 3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07920 "Joint Sealants" for application indicated.
 4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07920 "Joint Sealants" for application indicated.

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5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal drip edge.
 6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
 7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
- D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.10 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.11 CAVITY WALLS

- A. Bond wythes of cavity walls together using the following method:
1. Ladder reinforcing engaging both cmu and brick.
- 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.
- C. Install Bituminous Dampproofing in accordance with section 07115.

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- D. 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.

3.12 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 rigid insulation & 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.

3.13 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

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3.14 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

- B. 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. Crush masonry waste to less than **4 inches (100 mm)** in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 02300 "Earthwork."
 - 3. Do not dispose of masonry waste as fill within **18 inches (450 mm)** of finished grade.

- C. Excess Masonry Waste: 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 05310 - STEEL DECK

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. Roof deck.
 - 2. Composite floor deck.
 - 3. Noncomposite form deck.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for concrete fill.
 - 2. Division 5 Section "Structural Steel" for shop- and field-welded shear connectors.
 - 3. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 4. Division 9 painting Sections for repair painting of primed deck.

1.3 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: For each type of steel deck, signed by product manufacturer.
- D. Welding certificates.
- E. Field quality-control test and inspection reports.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - 1. Power-actuated mechanical fasteners.
- G. Research/Evaluation Reports: For steel deck.

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1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.
- B. Source Limitations for Electrified Cellular Floor Deck: Obtain cellular floor-deck units and compatible electrical components, such as preset inserts, activation kits, afterset inserts, service fittings, header ducts, and trench header ducts, from same manufacturer.
- C. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those 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 of applicable testing and inspecting agency.
 - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- E. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- F. Electrical Raceway Units: Provide UL-labeled cellular floor-deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.
- G. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

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:

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1. Steel Deck:
 - a. ASC Profiles, Inc.
 - b. Canam Steel Corp.;The Canam Manac Group.
 - c. Consolidated Systems, Inc.
 - d. DACS, Inc.
 - e. D-Mac Industries Inc.
 - f. Epic Metals Corporation.
 - g. Marlyn Steel Decks, Inc.
 - h. New Millennium Building Systems, LLC.
 - i. Nucor Corp.; Vulcraft Division.
 - j. Roof Deck, Inc.
 - k. United Steel Deck, Inc.
 - l. Valley Joist; Division of EBSCO Industries, Inc.
 - m. Verco Manufacturing Co.
 - n. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
 1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade **[33 (230)]** zinc coating.
 - a. Color: Manufacturer's standard
 2. Deck Profile: Type WR, wide rib on drawing.
 3. Profile Depth: As indicated on drawing.
 4. Design Uncoated-Steel Thickness: As indicated on drawing.
 5. Span Condition: Triple span or more.
 6. Side Laps: Overlapped.

2.3 COMPOSITE FLOOR DECK

- A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:
 1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G90 (Z275) zinc coating.
 2. Profile Depth: As indicated on drawing.
 3. Design Uncoated-Steel Thickness: As indicated on drawing.
 4. Span Condition: Triple span or more.

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2.4 NONCOMPOSITE FORM DECK

- A. Noncomposite Steel Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:
1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230) G90 (Z275) zinc coating.
 2. Profile Depth: As indicated on drawing.
 3. Design Uncoated-Steel Thickness: As indicated on drawing.
 4. Span Condition: Triple span or more.
 5. Side Laps: Overlapped.

2.5 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch (1.90 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.
- J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and sloped recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.
- K. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.
- L. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

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- M. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
1. Weld Diameter: 5/8 inch (16 mm) , nominal.
 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12 inches (305 mm) apart in the field of roof and 6 inches (150 mm) apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.

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3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches (450 mm), and as follows:
1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
 2. Mechanically clinch or button punch.
 3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
1. End Joints: Lapped 2 inches (51 mm) minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches (305 mm) apart with at least one weld at each corner.
1. Install reinforcing channels or zees in ribs to span between supports and weld mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
1. Weld Diameter: 5/8 inch (16 mm), nominal.
 2. Weld Spacing: Space and locate welds as indicated on design drawings.
 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (910 mm), and as follows:
1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of [1-1/2 inches (38 mm)], with end joints as follows:
1. End Joints: Lapped.

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- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.
- F. Install piercing hanger tabs at 14 inches (355 mm) apart in both directions, within 9 inches (228 mm) of walls at ends, and not more than 12 inches (305 mm) from walls at sides, unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05310

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SECTION 05500 - METAL FABRICATIONS

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. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 2. Shelf angles.
 - 3. Loose bearing and leveling plates.
 - 4. Steel weld plates and angles for casting into concrete not specified in other Sections.
 - 5. Miscellaneous steel trim.

- B. Products furnished, but not installed, under this Section include the following:
 - 1. Loose steel lintels.
 - 2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

- C. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
 - 2. Division 4 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

- B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

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1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Metal nosings and treads.
 - 3. Paint products.
 - 4. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - 2. Provide templates for anchors and bolts specified for installation under other Sections.
 - 3. 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.
- C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- D. Welding certificates.
- E. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type **[304]** stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, **ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6)**; with hex nuts, **ASTM A 563 (ASTM A 563M)**; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- D. Lag Bolts: **ASME B18.2.1 (ASME B18.2.3.8M)**.

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- E. Wood Screws: Flat head, ASME B18.6.1.
- F. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- G. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
- H. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- I. Expansion Anchors: Wedge-type anchors with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material for Anchors in Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 9 painting Sections.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
 - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

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2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)**, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, **1/8 by 1-1/2 inches (3.2 by 38 mm)**, with a minimum **6-inch (150-mm)** embedment and **2-inch (50-mm)** hook, not less than **8 inches (200 mm)** from ends and corners of units and **24 inches (600 mm)** o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

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1. Furnish inserts if units are installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.8 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than **8 inches (200 mm)**, unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.9 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive **3/4-inch (19-mm)** bolts, spaced not more than **6 inches (150 mm)** from ends and **24 inches (600 mm)** o.c., unless otherwise indicated.
 1. Provide mitered and welded units at corners.
 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately **2 inches (50 mm)** larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with zinc-rich primer.
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.10 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates after fabrication.

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- C. Prime plates with zinc-rich primer.

2.11 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.12 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.
- D. Prime interior miscellaneous steel trim, where indicated with zinc-rich primer.

2.13 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry,

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unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

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- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

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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. Wood blocking and nailers.
 3. Wood furring and grounds.
 4. Wood sleepers.
 5. Plywood backing panels.

1.2 SUBMITTALS

1.3 QUALITY ASSURANCE

- A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria":
1. Dimension lumber framing.
 2. Laminated veneer lumber.
 3. Prefabricated wood I-joists.
 4. Rim boards.
 5. Miscellaneous lumber.

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. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

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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 all rough carpentry, unless otherwise indicated.
 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, furring, stripping, 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 framing members that are less than **18 inches (460 mm)** above the ground in crawlspaces or unexcavated areas.
 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).
 1. Use Exterior type for exterior locations and where indicated.
 2. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
 3. Use Interior Type A, unless otherwise indicated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings, and the following:
 1. Framing for raised platforms.

2.4 DIMENSION LUMBER FRAMING

- A. Maximum Moisture Content: 19 percent.
- B. Framing Construction, Stud, or No. 3 grade and any of the following species:
 1. Hem-fir (north); NLGA.
 2. Southern pine; SPIB.
 3. Douglas fir-larch; WCLIB or WWPA.
 4. Mixed southern pine; SPIB.
 5. Spruce-pine-fir; NLGA.
 6. Douglas fir-south; WWPA.
 7. Hem-fir; WCLIB or WWPA.
 8. Douglas fir-larch (north); NLGA.
 9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

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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.
 4. Cants.
 5. Furring.
 6. Grounds.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.
- C. For concealed boards, provide lumber with 15 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.

2.6 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, 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 fasteners 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.

2.8 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; **1-inch (25-mm)** nominal thickness, compressible to **1/32 inch (0.8 mm)**; selected from manufacturer's standard widths to suit width of sill members indicated.

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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. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Do not splice structural members between supports, unless otherwise indicated.
- D. 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.

3.2 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 06161 – ROOF SHEATHING AND 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:
 - 1. Roof sheathing
 - 2. Roof insulation.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETING

- A. Preliminary Roofing Conference: Before starting roof construction, conduct conference at location designated by the Owner
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.

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1.5 ACTION SUBMITTALS

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

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work, including:
 - 1. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.

- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of complying with performance requirements.

- C. Product Test Reports: For components of membrane roofing system, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

- B. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

- C. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

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1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Firestone Building Products
 2. GAF Materials Corporation Garland Company, Inc.
 3. Johns Manville
 4. Dow Chemical Company
 5. Georgia pacific Corporation
- B. Source Limitations: Obtain components including roof insulation, fasteners, and sheathing from manufacturer approved by metal roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required based on testing and field experience.

2.3 ROOF INSULATION

- A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2 felt or glass-fiber mat facer on both major surfaces, as manufactured or recommended by roofing manufacturer.

2.4 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

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- C. Roof Sheathing: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick.
 - 1. Products: Georgia Pacific Corporation, Dens Deck.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing manufacturer's representative and installer's representative present, for compliance with requirements and other conditions affecting performance of the Work:
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSTALLATION, GENERAL

- A. Comply with roofing system manufacturer's written instructions.
- B. Provide roof insulation with indicated minimum thickness over all areas.

3.4 INSULATION INSTALLATION

- A. Install insulation with long joints of insulation in a continuous straight line, with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - 1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- B. Install insulation under area of roofing to achieve required thickness. Install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

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- C. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together. Tape joints if required by roofing system manufacturer.

3.5 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
 - 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- B. Roofing system will be considered defective if it does not pass tests and inspections.
 - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.6 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

END OF SECTION 06161

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SECTION 07272 - FLUID-APPLIED MEMBRANE AIR BARRIERS

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 fluid-applied, vapor-permeable membrane air barriers.
- B. Related Requirements:
 - 1. Section 06160 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at location designated by Owner.
 - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.

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1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
2. Include details of interfaces with other materials that form part of air barrier.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
 1. Protect substrates from environmental conditions that affect air-barrier performance.
 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

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2.2 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-permeable air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa) when tested according to ASTM E 283, ASTM E 783, or ASTM E 2357.

2.3 VAPOR-PERMEABLE MEMBRANE AIR-BARRIER

- A. Fluid-Applied, Vapor-Permeable Membrane Air Barrier: synthetic polymer membrane.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Synthetic Polymer Membrane:
 - 1) Basis of Design: Grace, W. R., & Co. - Conn.; Perm-A-Barrier VP.
 - 2) Carlisle Coatings & Waterproofing Inc.; Barritech VP.
 - 3) Henry Company; Air-Bloc 31MR.
 - 4) Rubber Polymer Corporation, Inc.; Rub-R-Wall Airtight VP.
 - 5) Tremco Incorporated, an RPM company; ExoAir 230.
 - 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.0004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Minimum 10 perms (580 ng/Pa x s x sq. m) ASTM E 96/E 96M.
 - c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.

2.4 ACCESSORY MATERIALS

- A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.
- D. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- E. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- F. Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft (24- to 32-kg/cu. m) density; flame-spread index of 25 or less

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according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

- G. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O.
- H. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
 - 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

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3.3 JOINT TREATMENT

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 - 1. Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches (75 mm) along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.
- B. Gypsum Sheathing: Fill joints greater than 1/4 inch (6 mm) with sealant according to ASTM C 1193 and air-barrier manufacturer's written instructions. Apply first layer of fluid air-barrier material at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a second layer of fluid air-barrier material over joint reinforcing strip.

3.4 TRANSITION STRIP INSTALLATION

- A. General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install butyl strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- F. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.

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- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- I. Seal top of through-wall flashings to air barrier with an additional **6-inch- (150-mm-)** wide, transition strip.
- J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending **6 inches (150 mm)** beyond repaired areas in strip direction.

3.5 FLUID AIR-BARRIER MEMBRANE INSTALLATION

- A. General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 3. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- B. Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.
 - 1. Vapor-Permeable Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than **40-mil (1.0-mm)** dry film thickness.
- C. Door, window, and similar openings: Apply membrane air barrier and the manufacturer's recommended mesh reinforcing at opening perimeter. Extend air barrier and mesh 3 inches across the face of the wall substrate, around the perimeter corner, and into the opening across the full depth of the head, jamb, and sill (as applicable) framing.
- D. Apply strip and transition strip over cured air-barrier material overlapping 3 inches (75 mm) onto each surface according to air-barrier manufacturer's written instructions.
- E. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- F. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

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3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Continuous structural support of air-barrier system has been provided.
 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 4. Site conditions for application temperature and dryness of substrates have been maintained.
 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 6. Surfaces have been primed, if applicable.
 7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 8. Termination mastic has been applied on cut edges.
 9. Strips and transition strips have been firmly adhered to substrate.
 10. Compatible materials have been used.
 11. Transitions at changes in direction and structural support at gaps have been provided.
 12. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 13. All penetrations have been sealed.
- C. Tests: As determined by Owner's testing agency from among the following tests:
1. Qualitative Air-Leakage Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, smoke pencil with pressurization or depressurization.
- D. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient air-barrier components for retesting as specified above.
- E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.7 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than **150** days or limits prescribed by manufacturer, whichever is less, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.

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2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 07272

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SECTION 07534 - FULLY ADHERED MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Roof Insulation
 2. Fully Adhered Membrane Roof System.
 3. Membrane roof flashing.
 4. Related accessories.
 5. Wind Load Engineering and attachment of Membrane Roofing System.
- B. Related Documents
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.
- C. Related Sections:
1. Section 07620, Flashing and Sheet Metal
 2. Section 07720, Roof Accessories
 3. Section 06100, Rough Carpentry

1.2 GENERAL REQUIREMENTS

- A. In the event these Specifications deviate from the Membrane Roofing Manufacturer's (*MRM Manufacturer's*) current specifications, these specifications shall prevail, except where they conflict with the *MRM Manufacturer's* requirements for the required warranty. In this case, the *MRM Manufacturer's* specifications shall prevail.
- B. The Membrane Roofing System as specified, shall only be installed by a state certified roofing contractor, authorized in writing by the *MRM Manufacturer* prior to bid.
- C. Drawings, addenda and modifications may be issued subsequent to the printing of these specifications. The General Contractor / Authorized Roofing Contractor, shall ascertain that such amendments to these Specifications are workable alterations.
- D. Prior to the project start, the General Contractor / Authorized Roofing Contractor shall determine that all aspects of these Specifications and possible modifications are workable and do not conflict with the *MRM Manufacturer's* requirements for the specified warranty.
- E. Upon commencement of the work, the Authorized Roofing Contractor assumes the responsibility for confirmation that these Specifications and drawings, addenda and modifications are satisfactory to the *MRM Manufacturer*.
- F. The Authorized Roofing Contractor shall supply all materials required for a complete Membrane Roofing System, including accessory products.

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1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. D 751 - Standard Test Methods for Coated Fabrics.
 - 2. E 96 - Test Methods for Water Vapor Transmission in Sheet Form.
 - 3. E 108 - Standard Test Methods for Fire Testing of Roof Coverings.
- B. Federal Specifications (FS):
 - 1. FS 101B, Method 2031 - Tear Strength
- C. Factory Mutual Engineering and Research (FM)
 - 1. Factory Mutual Test Standard 4470
 - 2. Minimum 1-105 windstorm classification
 - 3. FM Loss Prevention Data Sheet 1-49
 - 4. FM Loss Prevention Data Sheet 1-28
 - 5. FM Loss Prevention Data Sheet 1-28S
 - 6. FM Loss Prevention Data Sheet 1-29S
- D. Underwriters Laboratories, Inc. (UL)
 - 1. UL 790: Tests for Fire Resistance of Roof Covering Materials
 - 2. UL Fire Resistance Directory
- E. American Society of Civil Engineers (ASCE):
 - 1. ASCE Standard 7-93

1.4 SYSTEM DESCRIPTION

- A. Fully adhered, high performance Thermoplastic Membrane Roofing System:
 - 1. Provide all labor, materials and equipment necessary to deliver and install a complete fully adhered Thermoplastic Membrane Roofing System as specified and where indicated in project drawings.
 - 2. Provide labor, materials and equipment necessary to deliver and install rigid insulation as specified and where indicated in project drawings.
 - 3. Provide wind engineering design to comply with Article 1.10 of this Section.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01330 unless otherwise directed.
- B. Product Data and System Calculations:
 - 1. Submit latest edition of *MRM Manufacturer's* roofing and flashing specifications, edited specifically for this project, including a list of materials proposed for use, installation procedures, and *MRM Manufacturer's* data sheets for all products comprising roof system assembly as required to demonstrate compliance with specified requirements.

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2. Submit complete material list, Material Safety Data Sheets and installation procedures for all items not furnished by *MRM Manufacturer*, proposed to be furnished and installed under this section.
 3. The *MRM Manufacturer's* recommended methods of installation (unless superseded by the specification) will become the basis for inspecting and acceptance or rejection of the actual installation procedures used on this work.
 4. Submit Material Safety Data Sheets (MSDS) for all liquids, adhesives and sealants to be used on the project.
 5. Certified test reports indicating compliance with performance requirements and regulatory requirements specified herein.
- C. Shop Drawings:
1. Submit installation details of roofing and flashing, including seam layout, roof slopes, flashing details, penetration details and accessories.
 2. Submit shop drawings detailing roof configuration and sheet layout, details at perimeter, and special conditions.
 3. Submit flashing details for each flashing condition. *MRM Manufacturer's* standard pre-printed details are not acceptable as shop drawings.
- D. Samples:
1. Submit three 5 inch by 9 inch samples of approved Membrane Roofing Membrane with welded splice joint.
 2. Submit three samples of each of the following:
 - a. 6 inch by 6 inch insulation board.
 - b. Termination fastening devices, each type.
- E. Certificates:
1. Submit certification that materials and components furnished for Membrane Roofing System are products of single manufacturer or products acceptable to *MRM Manufacturer*.
 2. Submit certification that all materials furnished are compatible with one another and specific decking and are suitable for their intended use.
 3. Upon completion of work, submit *MRM Manufacturer's* Certificate of Final Inspection.
 4. Submit Authorized Roofing Contractor's Statement of Qualifications.
- F. *MRM Manufacturer's* Reports:
1. Submit *MRM Manufacturer's* review and approval of project shop drawings.
 2. Submit *MRM Manufacturer's* acceptance of warranty conditions.
 3. Submit *MRM Manufacturer's* field quality control, inspection reports.
 4. Submit Certification from *MRM Manufacturer* that the membrane for the project meets the definition for a membrane found within Section 4. Material and Manufacturer and minimum physical requirements (Table 1) of Standard D 6754.
- G. Warranty:
1. Submit *MRM Manufacturer's* and Authorized Roofing Contractor's warranties in compliance with Section 1.11.
- H. Maintenance Data:

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1. Submit *MRM Manufacturer's* recommended maintenance procedures for roofing system, including precautions and warnings to prevent damage and deterioration to Membrane Roofing System.

1.6 QUALITY ASSURANCE

A. Qualifications of *MRM Manufacturer*:

1. Membrane Roofing Membrane used in the work included in this section shall be produced by a highly reputable *MRM Manufacturer*, regularly engaged, without interruption, in the manufacture of the specified Membrane Roofing.
2. Membrane Roofing Membrane must have been manufactured and commercially sold, without a significant formulation change, for a minimum of fifteen (15) years.

B. Authorized Roofing Contractor Qualifications:

1. Firm experienced in application or installation of systems similar in complexity to those required for this project.
2. Authorized, in writing, by *MRM Manufacturer*.
3. Successful completion of a minimum 5 projects of comparable scale and complexity.
4. An adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this section.
5. Maintain full-time supervisor/foreman, not workman/foreman, on job site during times that roofing work is in progress. Supervisor must have minimum of three years experience in roofing work similar to the nature and scope specified.
6. A new and complete roofing installation is required by these specifications. An installation with an excess number of patches, splices, or small pieces will not be accepted. Such an installation shall be completely removed and replaced with the specified quality of workmanship at no additional costs to the Owner.

C. Project Acceptance

1. Authorized Roofing Contractor shall submit a completed and approved *MRM Manufacturer's* request for warranty form along with required shop drawings of the roof(s) showing all dimensions, penetrations and details.
2. The request for warranty form shall contain all pertinent information applicable to the project including:
 - a. Deck type(s)
 - b. Insulation type(s)
 - c. Membrane assembly and type.

D. Product / Material Qualifications

1. Test Reports
 - a. UL Class A Fire Hazard Classification
 - b. FM 1-105 Windstorm Classification
2. Roof insulation: Approved in writing by *MRM Manufacturer* as acceptable substrate for this Project and listed by UL for required fire rating.
3. Use only those materials and methods of installation specifically approved by *MRM Manufacturer*.

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E. Regulatory Requirements:

1. General Contractor / Roofing Contractor shall conform to regulations of public agencies, including specific requirements of the city, county, or state of jurisdiction.
2. FM 1-105 windstorm rating
3. FM Loss Prevention Data Sheets
4. UL Class A Fire Hazard Classification

F. Pre-Installation Conference:

1. Convene 1 week prior to commencement of Membrane Roofing installation.
2. Authorized Roofing Contractor shall notify Owner, Architect, Roof Consultant, General Contractor, job superintendent, *MRM Manufacturer's* technical representative and roof insulation manufacturer's representative 10 days prior to pre-installation conference.
3. Purpose of this conference will be to review contract requirements and discuss schedules, work procedures, coordination, proposed materials and quality control.

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery

1. Deliver all packaged materials to the job site in their original, unopened container with all labels intact and legible at the time of the inspection.
2. Labels shall contain manufacturer's material name, date of manufacturer and lot number.

B. Storage and Protection

1. All materials shall be stored raised above the deck or ground and covered with tarps or similar "breathable" covers. Covering shall be secured to resist wind and weather. Factory wrappings or clear polyethylene film shall not be used as sole coverings
2. All adhesives, primers, and caulking shall be stored between 50 degrees F. and 80 degrees F. Primers and caulking and adhesive exposed to freezing temperatures shall not be used and shall be removed from the job site.
3. Use all necessary means to protect the materials in this section before, during, and after installation, and to protect the work and materials of all other trades.
4. All material which becomes wet, broken, damaged or otherwise unsuitable for use in a top quality installation shall be promptly marked and removed from the site. Work found to be installed using damaged materials shall be removed and replaced at the General Contractor / Roofing Contractor's expense.

1.8 PROJECT CONDITIONS

A. Environmental Requirements:

1. Thermoplastic Membrane Roofing, flashing, insulation and adhesives shall not be applied when the surrounding air and surface temperature, relative humidity, or wind velocity is not within the range acceptable under the *MRM Manufacturer's* recommendations.
2. Cements and adhesives shall not be exposed to temperatures lower than 50 degrees F. for no more than four hours, or such other minimums published by respective manufacturers.

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3. Do not expose membrane and accessories to constant temperature in excess of secondary materials only as recommended by manufacturer of the primary material, as specified.

1.9 SEQUENCING AND SCHEDULING

- A. Perform roofing and flashing work as a single integrated unit of work, without division of responsibility between separate installers.
- B. Install new Membrane Roofing System immediately after insulation installation.
- C. All insulation shall be covered with Membrane Roofing at the end of each work day.
- D. In the event of unforeseen inclement weather, installed insulation shall be covered with temporary waterproofing covers.
- E. Authorized Roofing Contractor shall complete roofing work on a daily basis with each section completed before progressing to the next day's work, unless specifically directed otherwise by the owner's representative.
- F. Completion of work shall be defined as the installation of all specified roof preparation, insulation, field membrane, flashing, counter flashing, sheet metal, fasteners, and caulking.

1.10 SYSTEM PERFORMANCE CRITERIA

- A. Design installation to meet FM 1-60 for field zone, FM 1-105 for perimeter zone, FM 1-150 for corner zone.
- B. Installation shall have a Class A fire rating.

1.11 WARRANTY

- A. As part of the work of this section, pay all required fees, secure all required inspections, and complete all items necessary to secure and deliver to the owner the *MRM Manufacturer's* 20 year, labor-and-material warranty.
- B. *MRM Manufacturer* shall provide a "total system warranty" for a period of 20 years from Date of Substantial Completion.
- C. Warranty shall be limited to repairs, or replacement, as required to maintain the Membrane Roofing System in a watertight condition.
- D. Exclusions, listed under Terms and Conditions of the Warranty, shall conform to generally accepted industry standards except for the following:
 1. Warranty shall be no dollar limit.
 2. Warranty shall contain no exclusion for "gale" force winds.
 3. Warranty shall contain no exclusion for ponding water.

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PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Obtain primary thermoplastic Membrane Roofing from a single manufacturer and provide secondary materials only as recommended by manufacturer of primary material specified.
- B. The drawings are generic and not based on a specific manufacturer. Detail deviations will be accepted so as to permit utilization of the selected *MRM Manufacturer's* standard products and details when, in the Owner / Owner's representative's judgment, such deviations do not materially detract from design concept or intended performance.
- C. Acceptable manufacturers: Seaman Corporation Fibertite Roofing Systems.

2.2 MEMBRANE ROOFING MEMBRANE

- A. FiberTite nominal 36-mil ketone ethylene ester (KEE) membrane, reinforced with a 5.0 oz yd² knitted polyester fabric and heat-bonded 4 oz polyester (fleece) backing, as manufactured by Seaman Corporation, under the trade name FiberTite, conforming to the physical properties as outlined in the associated data sheet. FiberTite exceeds all requirements outlined in ASTM D 6754 Standard Specification for Ketone Ethylene Ester (KEE) Sheet Roofing.

2.3 INSULATION

- A. Insulation shall be installed, where specified and/or required to provide a suitable surface for the FiberTite Roofing System and/or meet desired thermal values.
- B. Acceptable products must be pre-approved in writing by Seaman Corporation and comply with the minimal characteristics and classification listed for the products below:
- C. Approved Product:
 - 1. FTR-Value Polyisocyanurate
 - 2. FM approved rigid insulation meeting Class A 1-90, for fire and wind.
 - 3. UL Classification : Class A.
 - 4. Density: 2.0 pcf. Minimum
 - 5. Meet requirements of ASTM C1289

2.4 FLASHING MATERIALS

- A. Flashing materials shall be supplied by the *MRM Manufacturer* or shall be approved in writing by the *MRM Manufacturer*.
- B. Flashing materials shall be the same material as the roofing membrane or membrane coated metal unless specified otherwise.
 - 1. Flashing to be reinforced membrane.
 - 2. Drain flashing to be minimum 60 mil non-reinforced membrane.

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2.5 ACCESSORIES

- A. The following products are supplied by the *MRM Manufacturer* and shall be incorporated into the roof assembly where noted in approved shop drawings.
1. Bonding Adhesive: VOC compliant, contact type, bonding adhesive, designed for bonding Membrane Membrane(s) to clean and dry, pre-approved horizontal or vertical substrates.
 2. Mastic: To adhere membrane(s) to vertical surfaces, a trowel grade elastomeric sealant.
 3. Sealant: To seal flashing termination(s), a one-component gun-grade polyurethane sealant.
 4. Pourable Sealer: A topping to seal "pitch pans", a one component pourable, self leveling, polyurethane sealant.
 5. Coated Metal: To fabricate metal flashing, 4' x 10' sheets of 24 gauge hot dipped G-90 steel, laminated with a 15 mil polymeric coating.
 6. Pre-Molded Flashing: Vent stack and inside/outside corner flashing, thermal-formed from non-reinforced Membrane.
 7. Non-Reinforced Membrane: Field fabrication membrane, 60 mil non-reinforced Membrane
 8. Protection Pads: (2' x 4' x 1/4" thick pad) High grade vinyl walk protection material with ribbed "slip resistant" design.
 9. Fastening Devices:
 - a. Termination Bar: Membrane flashing restraint / termination / compression seals, nominal 1/8" x 1" x 10' 6060-T5 extruded aluminum bar with pre-punched slots, 8" o/c.

2.6 RELATED MATERIALS

- A. Wood Nailers: Treated wood nailers shall be installed at all perimeter locations as noted on approved drawings.
1. Wood nailers shall be wood-preservative treated.
 2. Wood nailers shall be secured to the substrate to resist a minimum 300 pounds per linear foot.

PART 3 - EXECUTION

3.1 EXAMINATION OF SURFACES

- A. The Authorized Roofing Contractor shall inspect the roof deck and surfaces to receive new materials, prior to commencement of the roofing work, and shall notify the Architect in writing of any defects observed. Roofing work shall not proceed until any such defects are corrected to the satisfaction of the Architect. Materials shall not be installed over rough, uneven or improperly prepared surfaces.
- B. Commencement of work by Authorized Roofing Contractor shall constitute acceptance of the existing conditions as suitable for the successful completion of the work.
- C. It is the intent of this specification that the roofing system be installed as a complete assembly. Installation shall not proceed until all nailers and blocking are in place, all openings in the roof

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deck are permanently supported with steel framing, all curbs and similar equipment are on the project site ready for installation, and all work of other trades on the roof is completed to the extent practical.

- D. General Contractor / Roofing Contractor shall provide suitable protection for any completed areas of roof if additional work is required in these areas. If the new roofing system is distorted, stained, compressed, or otherwise damaged prior to final completion of the entire project, General Contractor / Roofing Contractor shall replace the involved areas at no additional cost to the Owner.
- E. Authorized Roofing Contractor shall keep all roof areas free of trash, debris, and excess materials at all times. General Contractor / Roofing Contractor shall supervise the work of all trades to prevent damage to the completed roofing system and to prevent the accumulation of scraps, metal shavings, fasteners, tools, etc. which could puncture the roof membrane. Accumulation of debris of any type on the Membrane roofing System shall require removal and replacement of the affected areas, if required by the Architect / Owner.
- F. Inspect decking before work is commenced for projections, inadequate anchorage, low areas, incorrect slopes, holes or voids, foreign materials and other unacceptable conditions. Correct defects in surfaces prior to commencing work.
- G. Perform pull tests on decking and nailers using proposed fasteners. Perform a minimum of five (5) tests for each condition of installation (field, perimeter, and corner), for each 20,000 sq. ft. of roof or portion thereof, and for each distinct roof area (and building). Perform additional tests necessary to isolate and rectify failures. Pull tests are not required for new Class 1 Decking. (min. 22 ga. steel, min. 3/4 in. treated plywood, min. 300 psi. concrete)
- H. Examine the areas and conditions under which work in this section will be installed. Correct conditions detrimental to the proper and timely completion of work. Do not proceed until such conditions have been corrected.

3.2 WOOD NAILERS

- A. Install continuous treated wood nailers at the perimeter of the entire roof and around roof projections and penetrations as specified on project drawings and approved shop drawings.
- B. Nailers shall be anchored to resist a minimum force of 300 pounds per linear foot in any direction.
- C. A 1/2 inch space shall be provided between nailer lengths. Nailer lengths shall not be less than 3 feet long.
- D. Nailer attachment shall conform to current Factory Mutual Loss Prevention Data Sheet 1-49.
- E. Thickness shall be as required to match insulation height to all allow for a smooth, flush condition.

3.3 ROOF INSULATION

- A. General

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1. Roof insulation shall be installed where by the long dimension of the board(s) run in parallel alignment and the short dimensions are staggered.
2. Insulation shall be installed with minimum joint dimensions and shall be tightly butted where possible. Maximum joint widths shall be 0.375 of an inch. Damaged corners shall be cut out and replaced with an insulation piece a minimum of 12" x 12". Pieces that are cut from larger panels and are smaller than one square foot are not acceptable.
3. Install no more than can be covered during the same working day.
4. When multiple layers are installed each layer shall be offset from the previous layer a minimum of 12" on center.

B. Adhered Insulation

1. The insulation manufacturer must recommend and approve the specific board and adhesive combination in writing prior to Seaman Corporation granting approval for this method of securement for steel deck applications.

C. Polyurethane Adhesive

1. Adhesive shall be applied only to properly prepared and preapproved substrates, free of any debris, dirt, grease, oil or moisture.
2. The minimum product temperature at time of application shall be per manufacturew's rerquirements.
3. Adhesives shall not be applied when surface or ambient temperatures are below 40° or above 110° F.
4. Insulation shall be fully bonded to the substrate with a maximum board size of 4' x 4'.
5. Insulation shall be set into a continuous 0.5" bead of adhesive at a minimum rate of one linear foot of adhesive for every one square foot of insulation board. Required rate of adhesive application shall be determined by manufacturer to comply with uplift resistance requirements.
6. Adhesive rates are to be increased in roof perimeter and corner zones according to specific project requirements and manufacturer's design recommendations.
7. Place the boards onto the adhesive beads and walk on the boards, spreading the adhesive for maximum contact.
8. Provide a second walking after 10 minutes to ensure maximum contact and bond strength.

3.4 INSTALLATION OF ROOFING MEMBRANE

A. General Requirements:

1. The Membrane Roofing System shall be installed by *MRM Manufacturer* trained and Authorized Roofing Contractor. All *MRM Manufacturer's* installation instructions and recommendations shall be strictly followed.
2. The methods of installation shall be in strict accordance with the approved details submitted on the shop drawings.
3. It is the intent of the drawings and specifications that the design details shall be followed precisely, being modified only where specifically required to meet field conditions or *MRM Manufacturer's* warranty requirements.
4. Utilize details approved by *MRM Manufacturer* for roof wall junctures and penetrations that are not specifically detailed on the project drawings.
5. Take precautions to ensure that water does not flow beneath any sections of completed roof.
6. At no time shall any portion of the assembly be exposed to moisture. If temporary seals are not installed on a daily basis, Authorized Roofing Contractor shall be required to

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remove and replace any completed roof area, to the deck, for a minimum distance of 10 feet from the edge or until dry materials are found, whichever is greater, at no additional cost to the Owner.

7. Membrane must be totally installed over all insulation installed in any given day. This includes sealant, flashing and trim. Failure to complete flashing and seam welding on a daily basis will be cause for rejection of the installed roof and will require replacement of the areas involved.

B. Lay-out:

1. Membrane shall be installed in a neat and orderly fashion.
2. Unroll and position roofing membrane, without stretching, over the approved substrate. Rolls of Membrane Roofing are to be positioned and installed straight and snug but not taut.
3. Adjoining rolls shall overlap five (5) inches, properly shingled with the flow of water where possible.
4. When using pre-fabricated panel rolls, stagger the factory seams to prevent adjacent welds from falling on top of one another.
5. When using conventional roll goods, stagger the roll ends to prevent adjacent welds from falling on top of one another.

C. Membrane Installation (with Basis-of-Design product)

1. FiberTite Fleece Back Membrane Adhered with FTR-290 Adhesive
 - a. For *all* FB membranes unroll approximately 30 feet of the FiberTite-FB membrane and position the roll over the properly installed/prepared substrate. Pull the tail back over the roll to expose a workable area (approx. 30') of substrate.
 - b. Apply a 100% continuous coat of adhesive to the substrate.
 - c. The amount of substrate that can be coated with a workable amount of adhesive will be determined by application method, ambient temperature, humidity and available manpower.
 - d. To ensure proper application and curing of the adhesive, the outside air temperature shall be above 40°F and rising.
 - e. FTR-290 adhesive may be applied by spraying and back rolling or just rolling. Do not dump adhesive or pour from the cans.
 - f. Roller applied adhesive shall utilize a solvent resistant $\frac{3}{8}$ " nap roller.
 - g. Spray applied adhesive must also be rolled out by roller to ensure a smooth, even 100% coverage of the substrate with no voids, skips, globs, puddles or similar irregularities.
 - h. Allow the solvents in the adhesive to slightly dissipate/cure only to the point that the adhesive is sticky but still wet. Do not allow adhesive to dry.
 - i. Adhesives shall not be installed over moist or wet substrates.
 - j. Broom the adhered portion of the membrane to ensure full contact and complete the bonding process by firmly pressing the bonded membrane into place with a weighted, foam-covered, lawn roller.
 - k. Repeat the process for the remaining unbonded portion of the membrane, lapping subsequent, adjacent rolls of membrane a minimum of 3", ensuring proper shingling of the membrane to shed water along the laps.
 - l. No adhesive shall be applied to the lap seam areas of the membrane. Areas contaminated with adhesive are difficult to clean, will impair proper welding of the seams and require a membrane patch or strip.

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D. Welding:

1. All field seams exceeding 10 ft. in length shall be welded with an approved automatic welder.
2. All field seams must be clean and dry prior to initiating any field welding.
3. Remove foreign materials from the seams (dirt, oils, etc.) with Acetone, MEK, or authorized alternative. Use CLEAN WHITE COTTON cloths and allow approximately five minutes for solvents to dissipate before initiating the automatic welder. Do not use denim or synthetic rags for cleaning.
4. All welding shall be performed only by qualified personnel to ensure the quality and continuity of the weld.

E. Perimeters

1. The perimeter area of any particular roof shall be defined as the outer parallel boundary of the roof section or edge. Projects having variable roof levels shall treat the outer boundary of each level as a perimeter. Internal expansion joints, firewalls or adjoining building walls greater than 4 feet are not considered perimeter areas.
2. The width of the perimeter area shall be calculated to be either ten percent of the width of the roof section or forty percent of the building or section height above ground, whichever is less to a minimum of 4 ft.
3. Where field design pressures exceed -30 psf, perimeter enhancement shall be required.

F. Flashing

1. All flashing are to be totally bonded. Loose flashing will not be approved.
2. Flashing are to extend a minimum of 4" and a maximum of 8" onto the roof membrane. The splice must be sealed at least 3 inches beyond the fastener.
3. The membrane is to be secured at the roof perimeter, curbs, walls, and all projections and at changes in plane greater than 15 degrees.
4. Pitch pans are to be avoided. Prior approval is required for pitch pan use.
5. Flashing shall be secured at the top edge with fasteners spaced a maximum of 8 inches on center under metal counter flashing or cap.
6. Flashing to be as per details drawing when shown.

G. Inspection of Membrane and Flashing

1. Inspect completed membrane and flashing for punctures, tears and discontinuous welded seams.
2. Apply additional layer of membrane with rounded corners over punctures and tears, extending a minimum of 2 inches beyond damaged area in all directions.
3. Re-weld seams that were not originally welded, making sure to expose the entire "cold welded" area.

3.5 TEMPORARY SEALING DURING CONSTRUCTION

- A. At the end of each working day or at the sign of rain, install temporary, 100% watertight seal(s) where the completed new roofing adjoins the uncovered deck or existing roof surface.
- B. The Authorized Roofing Contractor shall create and maintain the temporary seal in such a manner to prevent water from traveling beneath the new and / or existing roof system.
- C. The use of plastic roofing cement is permissible when sealing to an existing built up roof.

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- D. If water is allowed to enter beneath the newly completed roofing, the affected area(s) shall be removed and replaced at no additional expense to the building owner.
- E. Prior to the commencement of work, cut out and remove all contaminated membrane, insulation roof cement or sealant and properly dispose of off site.

3.6 SHEET METAL

- A. Sheet metal work is specified under another section but Authorized Roofing Contractor shall examine metal work, and not commence work until metal work which precedes roofing work is satisfactory.
- B. Metal work done after roofing shall be done under direct supervision of this section.
- C. Coated "Clad" Metal
 - 1. All perimeter edge details are to be fabricated from vinyl coated metal as provided by *MRM Manufacturer*.
 - 2. Insure all fascia are minimum 2 inches lower than the bottom of the wood nailers.
 - 3. Fasten all metal flashing to wood nailers or approved substrate with approved fasteners 8 in. O/C.
 - 4. Break and install coated metal in accordance with approved details, insuring proper attachment, maintaining 1/2 in. expansion joints and the installation of a minimum 2" bond breaker tape prior to sealing the joint..
 - 5. Seal metal expansion joints with a 5" strip of Membrane Roofing Membrane welded to the coated metal.

3.7 FIELD QUALITY CONTROL

- A. Authorized Roofing Contractor QC
 - 1. Authorized Roofing Contractor will initiate a QC program to govern all aspects of the installation of the new mechanically attached Membrane Roof System.
 - 2. The project foreman and or supervisor will be responsible for the daily execution of the QC program which will include but is not limited to the supervision, inspection and probing of all heat welding incorporated within the Membrane Roof System.
 - 3. If inconsistencies in the quality of the welds are found, all work shall cease until corrective actions are taken to insure the continuity of all field and detail welding.
- B. MRM Manufacturer's Field Service
 - 1. During installation, provide periodic on-site inspection by technical service representative of *MRM Manufacturer* to comply with warranty requirements.
 - 2. Site visits and field notes during inspections shall be included in the project job log.
 - 3. Copies of the inspection reports shall be forwarded to the Architect within 48 hours of the site visit.
 - 4. Upon completion of installation, provide final inspection by technical service representative of *MRM Manufacturer* to confirm that roofing system has been installed in accordance with *MRM Manufacturer's* requirements.

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3.8 ADJUSTING

- A. Restore to original condition or replace work or materials damaged during handling and installation of roofing membrane.

3.9 CLEANING

- A. The Authorized Roofing Contractor shall clear the construction areas and shall provide for all necessary removal from the building site of all construction debris associated with the installation of the Membrane Roof System.
- B. All debris shall be removed from the premises promptly and the construction area left clean daily.
- C. General Contractor / Authorized Roofing Contractor is responsible to insure that subcontractors have properly removed and disposed of all debris relating to their contract.

END OF SECTION 07534

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SECTION 07620 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Formed wall flashing and trim.

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Show layouts, profiles, shapes, seams, dimensions, and details for fastening, joining, supporting, and anchoring sheet metal flashing and trim.
- C. Samples: For each type of sheet metal flashing and trim.

1.3 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 SHEET METALS

- A. Copper Sheet: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
 - 1. (mm) minimum and not less than 7/8 inch (22 mm) long, barbed with large head.
- B. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

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2.4 FABRICATION, GENERAL

- A. General: Custom 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 item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 1. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- D. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with elastomeric sealant concealed within joints.
- E. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal, and in thickness not less than that of metal being secured.

2.5 WALL SHEET METAL FABRICATIONS

- A. Openings Flashing in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend **4 inches (100 mm)** beyond wall openings. Form head and sill flashing with **2-inch- (50-mm-)** high end dams. Fabricate from the following material:
 - 1. Copper: **16 oz./sq. ft. (0.55 mm thick)**for all but sill flashing.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

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- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 1. Space cleats not more than **12 inches (300 mm)** apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet (3 m)** with no joints allowed within **24 inches (600 mm)** of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with elastomeric sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than **1-1/4 inches (32 mm)** for nails and not less than **3/4 inch (19 mm)** for wood screws.
 - 1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
 - 2. Aluminum: Use aluminum or stainless-steel fasteners.
 - 3. Copper: Use copper or stainless-steel fasteners.
 - 4. Stainless Steel: Use stainless-steel fasteners.
- H. Seal joints with elastomeric sealant as required for watertight construction.
- I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Prein edges of sheets to be soldered to a width of **1-1/2 inches (38 mm)** except where pretinned surface would show in finished Work.

3.2 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
 - 1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
 - 2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.3 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

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- B. Openings Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend **4 inches (100 mm)** beyond wall openings.

END OF SECTION 07620

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SECTION 07710 - MANUFACTURED ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Counterflashings and reglets.

1.2 PERFORMANCE REQUIREMENTS

- A. FMG Listing: Manufacture and install copings, & roof edge flashings that are listed in FMG's "Approval Guide" and approved for Windstorm Classification, Class 1- 90. Identify materials with FMG markings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show layouts of manufactured roof specialties, including plans and elevations. Identify factory- vs. field-assembled work.
- C. Samples: For each type of manufactured roof specialty indicated with factory-applied color finishes.
- D. Product Test Reports: Verifying compliance of copings & roof edge flashings with performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 EXPOSED METALS

- A. Aluminum Sheet: **ASTM B 209** (ASTM B 209M), alloy and temper recommended by manufacturer for use and finish indicated, finished as follows:
 - 1. Surface: Smooth, flat finish.
 - 2.

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3. High-Performance Organic Finish: Three-coat, thermocured system with color coats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604.

4.

B. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

1. High-Performance Organic Finish: Three-coat, thermocured system with color coats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604.

2.

2.3 CONCEALED METALS

A. Aluminum Sheet: **ASTM B 209 (ASTM B 209M)**, alloy and temper recommended by manufacturer for use and structural performance indicated, mill finished.

B. Aluminum Extrusions: **ASTM B 221 (ASTM B 221M)**, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

C. Elastomeric Sealant: ASTM C 920, elastomeric polysulfide polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, 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 COUNTERFLASHINGS AND REGLETS

A. Available Manufacturers:

1. Castle Metal Products.
2. Cheney Flashing Company.
3. Fry Reglet Corporation.
4. Hickman, W. P. Company.
5. Keystone Flashing Company.
6. Merchant & Evans, Inc.

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7. Metal-Era, Inc.
 8. MM Systems Corporation.
- B. Counterflashings: Manufactured units in lengths not exceeding **12 feet (3.6 m)** designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal in thickness indicated:
1. Copper: **16 oz./sq. ft. (0.55 mm thick)**.
- C. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashings indicated, from the following exposed metal in thickness indicated:
1. Copper: **16 oz./sq. ft. (0.55 mm thick)**.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install manufactured roof specialties according to manufacturer's written instructions. Anchor manufactured roof specialties securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.
1. Install manufactured roof specialties with provisions for thermal and structural movement.
 2. Torch cutting of manufactured roof specialties is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
- C. Install manufactured roof specialties level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.
- D. Install manufactured roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
- E. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than **1-1/4 inches (32 mm)** for nails and not less than **3/4 inch (19 mm)** for wood screws.
- F. Seal joints with elastomeric sealant as required by manufacturer of roofing specialties.

3.2 COUNTERFLASHING AND REGLET INSTALLATION

- A. Counterflashings: Coordinate installation of counterflashings with installation of base flashings. Insert counterflashings in reglets or receivers and fit tightly to base flashings. Extend counterflashings **4 inches (100 mm)** over base flashings. Lap counterflashing joints a minimum of **4 inches (100 mm)** and bed with elastomeric sealant.

END OF SECTION 07710

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SECTION 07841 – THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.2 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.
 3. L-Rated Systems if noted: Where through-penetration firestop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings indicated at both ambient temperatures and 400 deg F (204 deg C).
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

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1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.
- C. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems bearing classification marking of qualified testing and inspecting agency.
- B. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those systems indicated on Drawings
 - 1. A/D Fire Protection Systems Inc.
 - 2. Grace, W. R. & Co. - Conn.
 - 3. Hilti, Inc.
 - 4. Johns Manville.
 - 5. Nelson Firestop Products.
 - 6. NUCO Inc.
 - 7. RectorSeal Corporation (The).
 - 8. Specified Technologies Inc.
 - 9. 3M; Fire Protection Products Division.
 - 10. Tremco; Sealant/Weatherproofing Division.
 - 11. USG Corporation.

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2.2 FIRESTOPPING

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 FIELD QUALITY CONTROL

- A. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

END OF SECTION 07841

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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 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.

1.4 QUALITY ASSURANCE

- A. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 that is appropriate for the types of Project joints.

1.5 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion.

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

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- 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.
- 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. Multicomponent Nonsag Polysulfide Sealant:
 - 1. Products:
 - a. Pecora Corporation; Synthacalk GC-2+.
 - b. Polymeric Systems Inc.; PSI-350.
 - c. PolySpec Corp.; Thiokol 2P.
 - d. Sonneborn, Division of ChemRex Inc.; Sonolastic Polysulfide Sealant.
 - 2. Type and Grade: M (multicomponent) and NS (nonsag).
 - 3. Class: 25.
 - 4. Use[s] Related to Exposure: T (traffic).
 - 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

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.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

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.

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- 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 loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
 - 2. Remove laitance and form-release agents from concrete.
 - a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. 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:

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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 SUMMARY

- A. Section Includes:
 - 1. Hollow metal frames.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.
- C. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amweld Building Products, LLC.
 - 2. Ceco Door Products; an Assa Abloy Group company.
 - 3. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum **G90 (Z180)** metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), **40Z (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.

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- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- G. Mineral-Fiber Insulation: ASTM C 665, Type I.
- H. Glazing: Division 8 Section "Glazing."
- I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat.

2.3 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8.
- B. Interior Frames: Fabricated from cold-rolled steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as face welded unless otherwise indicated.
 - 3. Frames for Wood Doors: 0.042-inch- (1.0-mm-) thick steel sheet.
 - 4. Frames for Borrowed Lights: 0.042-inch- (1.0-mm-) thick steel sheet.
- C. Hardware Reinforcement: ANSI/SDI A250.6.

2.4 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.

2.5 FABRICATION

- A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- B. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. 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:

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- 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.
 - 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.
4. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.
- a. Single-Door Frames: Three door silencers.
- C. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 electrical Sections.
- D. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow metal work.
 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.6 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: ANSI/SDI A250.10.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.
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.

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- a. Remove temporary braces necessary for installation only after frames have been properly set and secured.
- b. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
2. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
3. 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.

3.2 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. 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.
- C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08110

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SECTION 08211 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Solid-core doors with wood-veneer faces.
 2. Factory finishing flush wood doors.

1.2 SUBMITTALS

- A. Product Data: For each type of door indicated. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
1. Indicate dimensions and locations of mortises and holes for hardware.
 2. Indicate dimensions and locations of cutouts.
 3. Indicate doors to be factory finished and finish requirements.
 4. Indicate fire-protection ratings for fire-rated doors.
- C. Samples: For factory-finished doors.

1.3 QUALITY ASSURANCE

- A. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Algoma Hardwoods, Inc.
 2. Ampco, Inc.
 3. Buell Door Company Inc.
 4. Chappell Door Co.
 5. Eagle Plywood & Door Manufacturing, Inc.
 6. Eggers Industries.
 7. Graham; an Assa Abloy Group company.
 8. Haley Brothers, Inc.
 9. Ideal Architectural Doors & Plywood.

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10. Ipik Door Company.
11. Lambton Doors.
12. Marlite.
13. Marshfield Door Systems, Inc.
14. Mohawk Flush Doors, Inc.; a Masonite company.
15. Oshkosh Architectural Door Company.
16. Poncraft Door Company.
17. Vancouver Door Company.
18. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
- B. WDMA I.S.1-A Performance Grade:
 1. Heavy Duty unless otherwise indicated.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
 1. Grade: Premium, with Grade A faces.
 2. Species: Maple.
 3. Cut: Plain sliced (flat sliced).
 4. Match between Veneer Leaves: Book match.
 5. Assembly of Veneer Leaves on Door Faces: Balance match.
 6. Core: Particleboard with lumber edging.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
- B. Factory machine doors for hardware that is not surface applied.

2.5 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory that are indicated to receive transparent finish.
- C. Transparent Finish:

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1. Grade: Premium.
2. Finish: AWI conversion varnish or catalyzed polyurethane system.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
5. Sheen: Semigloss.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 1. Clearances: Provide **1/8 inch (3.2 mm)** at heads, jambs, and between pairs of doors. Provide **1/8 inch (3.2 mm)** from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide **1/4 inch (6.4 mm)** from bottom of door to top of threshold unless otherwise indicated.
 - a. Comply with NFPA 80 for fire-rated doors.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION 08211

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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.
- B. See Division 8 door sections for astragals and door silencers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each exposed finish.
- C. 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.
 - 2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks.

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. 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.

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1. Test Pressure: Test at atmospheric pressure.

- C. 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

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in door and frame schedule.
 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

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2.2 HINGES, GENERAL

- A. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- B. Hinge Base Metal: Unless otherwise indicated, provide the following:
 - 1. Exterior Hinges: Stainless steel, with stainless-steel pin.
 - 2. Interior Hinges: Brass, with stainless-steel pin body and brass protruding heads.
 - 3. Hinges for Fire-Rated Assemblies: Steel, with steel pin.
- C. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors.
- D. Fasteners: Comply with the following:
 - 1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
 - 2. Wood Screws: For wood doors and frames.
 - 3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
 - 4. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

2.3 HINGES

- A. Butts and Hinges: BHMA A156.1.
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Manufacturers:
 - 1. Baldwin Hardware Corporation (BH).
 - 2. Bommer Industries, Inc. (BI).
 - 3. Cal-Royal Products, Inc. (CRP).
 - 4. Hager Companies (HAG).
 - 5. Lawrence Brothers, Inc. (LB).
 - 6. McKinney Products Company; an ASSA ABLOY Group company (MCK).
 - 7. PBB, Inc. (PBB).
 - 8. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

2.4 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than **5 lbf (22 N)**.
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than **15 lbf (67 N)** to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- C. Lock Trim:
 - 1. Levers:
 - 2. Dummy Trim: Match lever lock trim and escutcheons.

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- D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors.
- E. Backset: **2-3/4 inches (70 mm)**, unless otherwise indicated.
- F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set.

2.5 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
 - 1. Bored Locks: BHMA A156.2.
- B. Bored Locks: BHMA A156.2, Grade 1; Series 4000.
 - 1. Manufacturers:
 - a. Best Access Systems; Div. of The Stanley Works (BAS).
 - b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
 - c. Medeco Security Locks, Inc.; an ASSA ABLOY Group company (MED).
 - d. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
 - e. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
 - f. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).

2.6 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
- B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
 - 1. Number of Pins: Five.
- C. Permanent Cores: Manufacturer's standard; finish face to match lockset; with interchangeable cores.
- D. Construction Keying: Comply with the following:
 - 1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
- E. Manufacturer: Same manufacturer as for locks and latches.

2.7 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.
- B. Keys: Nickel silver[.]; permanently inscribed with a visual key control number and including the notation "DO NOT DUPLICATE."

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1. Quantity: In addition to one extra key blank for each lock, provide three cylinder change keys and five grand master keys.

2.8 OPERATING TRIM

- A. Standard: BHMA A156.6.
- B. Materials: Fabricate from aluminum, unless otherwise indicated.
- C. Manufacturers:
 1. Burns Manufacturing Incorporated (BM).
 2. Don-Jo Mfg., Inc. (DJO).
 3. Forms + Surfaces (FS).
 4. Hager Companies (HAG).
 5. Hiawatha, Inc. (HIA).
 6. IVES Hardware; an Ingersoll-Rand Company (IVS).
 7. Rockwood Manufacturing Company (RM).
 8. Trimco (TBM).

2.9 CLOSERS

- A. Accessibility Requirements: Comply with the following maximum opening-force requirements:
 1. Interior, Non-Fire-Rated Hinged Doors: **5 lbf (22.2 N)** applied perpendicular to door.
- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than **30 lbf (133 N)** to set door in motion and not more than **15 lbf (67 N)** to open door to minimum required width.
- C. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- D. Surface Closers for interior wood doors: BHMA A156.4, Grade 1. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
 1. Manufacturers:
 - a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
 - b. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
 - c. LCN Closers; an Ingersoll-Rand Company (LCN).
 - d. Norton Door Controls; an ASSA ABLOY Group company (NDC).
 - e. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
 - f. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).

2.10 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1.

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1. Provide wall stops for doors where possible. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
- B. Mechanical Door Holders: BHMA A156.16, Grade 1.
- C. Silencers for Door Frames: BHMA A156.16, Grade 1; neoprene or rubber; fabricated for drilled-in application to frame.

2.11 THRESHOLDS

- A. Standard: BHMA A156.21.
- B. Accessibility Requirements: Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than **1/2 inch (13 mm)** high.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum **1/2 inch (13 mm)** high.

2.12 FABRICATION

- A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- B. Fasteners: Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 1. Comply with NFPA 80 for fasteners of door hardware in fire-rated applications.
- C. Finishes: BHMA A156.18, as indicated in door hardware sets.

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."

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- 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.

3.2 DOOR HARDWARE SETS

Door Hardware Set No. 1 -
20 minute rated door in 1 Hour Fire Partition, Door, 102, 103, 105, and 106. Free egress both sides.

No.	Item	Description	Finish
3	Hanging Devices	Hinges.	26D
1	Securing Devices	Passage Lockset with ALP Trim *	26D
3	Accessories	Silencers	Grey
1	Closing Devices	Parallel Arm Closer	Grey

*Basis of design for ALP Trim by Yale, push pull latches commonly known as Hospital push/pulls.

Door Hardware Set No. 2 –
20 minute rated door in 1 Hour fire partition, Door 101, and 104.

No.	Item	Description	Finish
3	Hanging Devices	Hinges.	26D
1	Securing Devices	Privacy Lockset	26D
1	Closing Devices	Parallel Arm Closer with overhead stop/holder.	Grey
3	Accessories	Silencers	Grey

END OF SECTION 08710

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SECTION 09260 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum wallboard.
 - 2. Non-load-bearing steel framing.

1.2 SUBMITTALS

- A. Product Data: For each product indicated.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 STEEL FRAMING

- A. Steel Framing, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Metal complying with ASTM C 645 requirements.
 - a. Protective Coating:
 - 1) Interior Applications: manufacturer's standard corrosion-resistant zinc coating.
 - 2) Exterior Applications: ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating.
- B. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

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1. Available Products:
 - a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
 - b. Chicago Metallic Corporation; System.
 - c. USG Interiors, Inc.; Drywall Suspension System.

C. Partition and Soffit Framing:

1. Steel Studs and Runners: ASTM C 645, in depth indicated.
2. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch- deep flanges.
3. Cold-Rolled Channel Bridging: 0.0538-inch bare steel thickness, with minimum 1/2-inch-wide flange, and in depth indicated.
 - a. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch- thick, galvanized steel.
4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, in depth indicated.
5. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.3 PANEL PRODUCTS

- A. Panel Size, General: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Gypsum Ceiling Board: ASTM C 36. **(HALL SOFFITS)**
 1. Type X: 5/8 inch, with long edges tapered.
- C. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces. **(FAMILY SHOWER ROOM CEILINGS)**
 1. Core: 5/8 inch, Type X
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.

Provide trim designed to be concealed by finishing compound

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. Expansion (Control) Joint:

- B. Exterior Trim: ASTM C 1047, hot-dip galvanized steel sheet or rolled zinc.

Provide trim designed to be concealed by finishing compound

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

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3. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape:
 1. Interior Gypsum Wallboard: Paper.
 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, flanges of trim accessories, and fasteners, use setting-type taping compound. Fill Coat: For second coat, use drying-type, all-purpose compound.
 3. Finish Coat: For third coat, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
 1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.

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 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.

PART 3 - EXECUTION

3.1 NON-LOAD-BEARING STEEL FRAMING INSTALLATION

- A. General: Comply with ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
- B. Suspended Ceiling and Soffit Framing:

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1. Suspend ceiling hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Attach hangers to structural members. Do not support ceilings from or attach hangers to permanent metal forms, steel deck tabs, steel roof decks, ducts, pipes, or conduit.
4. Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.
5. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

C. Partition and Soffit Framing:

1. Where studs are installed directly against exterior walls, install isolation strip between studs and wall.
2. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
3. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb, unless otherwise indicated.
4. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

3.2 PANEL PRODUCT INSTALLATION

A. Gypsum Board: Comply with ASTM C 840 and GA-216.

1. Space screws a maximum of 12 inches o.c. for vertical applications.
2. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.
3. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
4. On partitions/walls, apply gypsum panels vertically, 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 board.
5. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

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3.3 FINISHING

- B. Installing Trim Accessories: 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.

- C. Finishing Gypsum Board Panels: 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.
 - 1. Prefill open joints and damaged surface areas.
 - 2. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
 - 1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
 - 2. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at all panel surfaces that will be exposed to view.

END OF SECTION 09260

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SECTION 09310 - CERAMIC TILE

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. Ceramic tile.
 - 2. Waterproof membrane.
 - 3. Crack isolation membrane.
 - 4. Metal corner/edge protection strips.
 - 5. Epoxy grout.
 - 6. Stone thresholds
- B. Related Sections:
 - 1. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. **Samples for Verification:**
 - 1. Mock up: Full-size units of each type and composition of tile and for each color and finish on assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12

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inches square but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.

2. Stone thresholds in 6-inch lengths.
3. Metal edge strips in 6-inch lengths.
4. Metal corner/edge protection in 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product, signed by product manufacturer.
- D. Material Test Reports: For each tile-setting and -grouting product.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each color or finish from one source or producer.
 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 1. Waterproof membrane.
 2. Joint sealants.
 3. Metal corner/edge protection strips.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Build mockup of each type of tile installation.
 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

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- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- C. Low-Emitting Materials: Tile flooring systems 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."
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
- E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

- A. Provide product materials, sizes, patterns, and colors indicated in the drawings, as identified in the Finish Legend and Finish Schedule.
 - 1. Mounting: Factory, back mounted.
 - 2. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size or Metal edge protection: As indicated on the Finish Legend.

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- b. External Corners for Thin-Set Mortar Installations: Metal corner/edge protection: Schluter Rondec, brushed stainless steel.
- c. Internal Corners: Field-buttet square corners.
- d. Marble thresholds: Double beveled, 2" x 3/8", Color to blend with floor tile color, as selected by designer. Submit full range of color options.

2.3 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product, selected from the following that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer. Run a minimum of 4" up walls.
- B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
 - 1. Noble Company (The); Nobleseal TS.
- C. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.
 - 1. Compotite Corporation; Composeal Gold.
- D. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bonsal American; an Oldcastle company; B 6000 Waterproof Membrane with Glass Fabric.
 - b. Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane.

2.4 SETTING MATERIALS

- A. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete Multipurpose Pro, white, or comparable polymer-modified product by one of the following:
 - a. Boiardi Products; a QEP company.
 - b. Bonsal American; an Oldcastle company.
 - c. Bostik, Inc.
 - d. C-Cure.
 - e. Custom Building Products.
 - f. Jamo Inc.
 - g. MAPEI Corporation.
 - h. Southern Grouts & Mortars, Inc.
 - i. Summitville Tiles, Inc.
 - j. TEC; a subsidiary of H. B. Fuller Company.
 - 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

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2.5 GROUT MATERIALS

- A. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D.
 - 1. Basis-of-Design Product: Provide Epoxy Grout in colors as indicated in the Finish Legend.

2.6 ELASTOMERIC SEALANTS

- A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 7 Section "Joint Sealants."
 - 1. Sealants shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Sealants 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."
 - 3. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

2.7 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal corner/edge protection: Schluter Rondec, brushed stainless steel. Provide Rondec endcaps at the exposed top of the metal corner/edge protection at wainscot installations.
- C. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 - 1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
 - 2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

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2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile installed with thin-set mortar with patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, pre-coat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

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- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in pattern indicated on Finish Schedule. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on walls or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on walls or trim, align joints unless otherwise indicated.
- F. Joint Widths: Install per manufacturer's recommendations, and as noted on Finish Schedule.
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
- I. Metal Corner/Edge Protection Strips: Install at outside corners and exposed edges.

3.4 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove epoxy grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect

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- metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, on Concrete:
1. Tile Installation TCNA F121: Cement mortar bed (thickset) on waterproof membrane.
 - a. Tile Type: Ceramic Tile, as indicated in drawings.
 - b. Mortar: latex-portland cement mortar.
 - c. Grout: Epoxy grout.
- B. Interior Wall Installations, Masonry:
1. Tile Installation TCNA W202: Thin-set mortar.
 - a. Tile Type: Ceramic Tile, as indicated in drawings.
 - b. Thin-Set Mortar: Dry-set portland cement mortar.
 - c. Grout: Epoxy grout.
- C. Shower Receptor Wall installations, Masonry:
1. Tile installation TCNA B421; Thinset mortar on waterproof membrane over masonry
 - a. Tile Type: Ceramic Tile, as indicated in drawings.
 - b. Thinset mortar: Improved modified dry-set mortar
 - c. Grout: Epoxy grout

END OF SECTION 09310

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SECTION 09672 - RESINOUS FLOORING

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 resinous flooring system with epoxy resin.
 - 1. Application Method: Troweled in place epoxy flooring with matte urethane seal coat.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. Samples for Verification: For each resinous flooring system required, 5 inches (150 mm) square, applied to a rigid backing by Installer for this Project.
- C. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- D. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. No request for substitution shall be considered that would change the generic type of floor system specified. Equivalent materials of other manufactures may be substituted only on approval of Architect or Engineer. Request for substitution will only be considered only if submitted 10 days prior to bid date. Request will be subject to specification requirements described in this section.
- B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
 - 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
 - 2. Contractor shall have completed at least 10 projects of similar size and complexity.
- C. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer, with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

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1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.
- B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects. Store material per Product Data sheet.
- C. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
 - 1. Maintain material and substrate temperature between 65 and 85 deg F (18 and 30 deg C) during resinous flooring application and for not less than 24 hours after application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.
- D. Concrete substrate shall be properly cured. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring

1.7 WARRANTY

- A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of one (1) one full years from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally warranting the materials and workmanship for a period of (1) one full year from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

PART 2 - PRODUCTS

2.1 RESINOUS FLOORING

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, the following:
- B. Products: Provide the following:

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1. SoyStep, Basis of Design
- C. System Characteristics:
1. Color and Pattern: As indicated by Architect in finish legend drawings.
 2. Wearing Surface: Standard
 3. Integral Cove Base: 8-inch above room floor finish
 4. Overall System Thickness: 3/16 inch.
- D. System Components: Manufacturer's standard components that are compatible with each other and as follows:
1. Body Coat(s):
 - a. Material Basis: SoyStep
 - b. Application Method: trowel.
 - 1) Thickness of Coats: 3/16"
 2. Topcoat:
 - a. Material Basis: Matte Urethane seal coat

Note: Components listed above are the basis of design intent; all bids will be compared to this standard including resin chemistry, color, wearing surface, thickness, and installation procedures, including number of coats. Contractor shall be required to comply with all the requirements of the Specifications and all of the components required by the Specifications, whether or not such products are specifically listed above.

2.2 ACCESSORY MATERIALS

- A. Patching, Leveling and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated. No Single component or cementitious materials.
- B. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

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- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 - 1. Mechanically prepare substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup or Diamond Grind with dust free system.
 - 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
 - 3. Verify that concrete substrates are dry.
 - a. Perform in situ probe test, ASTM F 2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 80 percent.
 - b. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 6 lb of water/1000 sq. ft. of slab in 24 hours.
 - c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions. Resinous materials only.
- D. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.2 APPLICATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
 - a. Apply joint sealant to comply with manufacturer's written recommendations.
- B. Apply primer where required by resinous system, over prepared substrate at manufacturer's recommended spreading rate.
- C. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and top coating of cove base. Round internal and external corners. Refer to detail drawings.

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- D. Mix and apply material coats as indicated for flooring system and at coverage rates recommended in writing by manufacturer.
- E. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 TERMINATIONS

- A. Chase edges to “lock” the coating system into the concrete substrate along lines of termination.
- B. Penetration Treatment: Lap and seal coating onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.
- C. Trenches: Continue coating system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.
- D. Treat floor drains by chasing the coating to lock in place at point of termination.

3.4 JOINTS AND CRACKS

- A. Treat control joints and to maintain monolithic protection.
- B. Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.
- C. Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.5 CLEANING, PROTECTING, AND CURING

- A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.
- B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.
- C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer. General contractor is responsible for cleaning prior to inspection.

END OF SECTION 09672

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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) Gypsum Drywall:
 - 1) All exposed surfaces, interior and exterior.
 - d) Wood:
 - 1) Painting of all wood doors and all millwork except that specified to be prefinished.
 - e) Mechanical Grilles and Diffusers and Electrical Panels noted to be field-painted:
 - 1) Paint to match color of surface in which item is mounted.
 - f) Masonry:
 - 1) Painting of all exposed concrete unit masonry.
 - g) Concrete:
 - 1) Paint all interior and exterior exposed concrete; excluding paving and curbs, unless noted otherwise.

D. Related Work Specified Elsewhere:

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

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1.3 QUALITY ASSURANCE

A. Source:

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

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. 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. Sherwin-Williams
 2. Benjamin Moore

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3. PPG Paints

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 WOOD PUTTY

- A. Commercial grade of putty composed of linseed oil, and whiting.

2.5 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.
 - 2. Do not proceed with work on concrete, masonry, plaster, or stucco until installation is fully cured.

3.2 PREPARATION OF SURFACES

- A. Verify Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
- B. 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.

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C. Wood Surfaces:

1. Sandpaper to smooth and even surface, and then dust off.
2. After priming coat has dried, apply shellac, four (4) pounds cut, to all knots, pitch and resinous sapwood.
3. After shellac coat has dried, putty all nail holes, cracks, open joints and other defects.
 - a) Putty shall be colored to match stain or paint.

D. 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.

E. Galvanized Surfaces:

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

F. 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.

G. Concrete and Masonry Surfaces:

1. Concrete and masonry surfaces to be painted shall be prepared by removing efflorescence, chalk, dust, grease, oil, excessive mortar, and other material detrimental to painting. Surfaces shall be thoroughly dry, properly cured, and clean before application of paint.

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. Quantity of colors:

1. Provide colors as indicated in the Finish Legend in the Drawings.

D. General Requirements for Workmanship:

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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 ensure 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.
- E. Workmanship for Exterior Painting:
1. Exterior door shall have tops, bottoms and side edges finished the same as the exterior faces of these doors.
- F. 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 WALL TYPE IDENTIFICATION

- A. Above the ceiling, label all smoke partition, fire partition, fire barrier, and smoke barrier wall assemblies.
- B. In spaces that have no ceiling, provide the labels approximately 8 to 10 feet above the floor, in locations visible to a person standing in the space.
- C. Labels shall be minimum 4" high with red lettering that is permanently stenciled or adhered to the assembly surface.
- D. Provide labels every 12-16 feet along the length of assemblies.
- E. In locations where two aligned assemblies meet, provide a red line marking the line of meeting, with appropriate labels on each side of the demarcation indicating the applicable assembly.
- F. Label wording: The text on the labels for each type of assembly shall match the text used in the legend on the Floor Plan in the drawings

3.5 PAINTING SCHEDULE

- A. PAINTING SCHEDULE - EXTERIOR:
1. Concrete and Masonry Surfaces:
 - a) Primer:
 - 1) One (1) Coat:

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- a) S-W: At Concrete: Loxon Concrete and Masonry Primer A24W8300
- b) S-W: At CMU: Loxon Block Surfacers A24W-00200
- b) Finish:
 - 1) Two (2) Coats:
 - a) S-W: SherLastic Elastomeric Coating A05W-00151
- 2. Ferrous Metal (100% Acrylic System)
 - a) Primer:
 - 1) One (1) Coat:
 - a) S-W: DTM Acrylic Primer/Finish B66W00001
 - b) Finish:
 - 1) Two (2) Coats:
 - a) S-W: Pro industrial DTM Acrylic semi-gloss B66W01151
- 3. Galvanized Metal and Aluminum (100% Acrylic System)
 - a) Primer:
 - 1) One (1) Coat:
 - a) S-W: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
 - b) Finish:
 - 1) Two (2) Coats:
 - S-W: Pro Industrial Acrylic Semi-Gloss, B66-650 Series

B. PAINTING SCHEDULE - INTERIOR

- 1. Ferrous Metal
 - a) Primer:
 - 1) One (1) Coat:
 - a) S-W: Kem Kromik Universal Metal Primer b50WZ0001
 - b) Finish: (Latex)
 - 1) Two (2) Coats:
 - a) S-W: ProMar 200 Zero VOC Interior Latex Semi-gloss B31W02651
- 2. Galvanized Metal
 - a) Primer:
 - 1) One (1) Coat:
 - a) S-W: Galvite HS Solvent Based Acrylic Coating B50WZ0030
 - b) Finish (Gloss):
 - 1) Two (2) Coats:
 - a) S-W: ProMar 200 Interior Alkyd Semi-gloss B34W02251
- 3. Gypsum Board Walls and Ceilings, Eggshell (100% Acrylic System)
 - a) Primer:
 - 1) One (1) Coat:
 - a) S-W: ProMar 200 Zero VOC Interior Latex Primer B28W02600
 - b) Finish: (Eggshell)
 - 1) Two (2) Coats:
 - a) S-W: ProMar 200 Zero VOC Interior Latex Eg-Shel B20W12651
- 4. Gypsum Board Walls and Ceilings, Semi-gloss (100% Acrylic System):
 - a) Primer:
 - 1) One (1) Coat:
 - a) S-W: ProMar 200 Zero VOC Interior Latex Primer B28W02600
 - b) Finish:
 - 1) Two (2) Coats:
 - a) S-W: ProMar 200 Zero VOC Interior Latex Semi-Gloss B31W02651

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5. Gypsum Board Walls and Ceilings, Eggshell, Epoxy:
 - a) Primer:
 - 1) One (1) Coat:
 - a) S-W: ProMar 200 Zero VOC Interior Latex Primer B28W02600
 - b) Finish:
 - 1) Two (2) Coats:
 - a) S-W: Pro Industrial PreCatalyzed Waterbased Epoxy Eg-shel

END OF SECTION 09910

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SECTION 10801 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Washroom & miscellaneous accessories.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule:
 - 1. Identify locations using room designations indicated on Drawings.
 - 2. Identify products using designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.
- B. See 3.2 Toilet Accessory Schedule for basis of design products.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

3.2 TOILET ACCESSORY SCHEDULE

- A. The following items will be furnished by the Owner and installed by the Contractor: Verify the location for installation of these items with the Owner.

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1. Paper Towel Dispensers.
 2. Soap Dispensers
 3. Sanitizer Dispensers
 4. Toilet Tissue Dispensers.
- B. The following items are to be provided by the Contractor:
1. Water Closet and Shower Grab Bars: Bobrick 68 Series.
 - a. See drawings for lengths and configuration.
 2. Robe Hook: Bobrick B-6827
 3. Shower Curtain Rod: Bobrick B-207
 4. Vinyl Shower Curtains: Bobrick B-204-2 (42" wide)
 5. Shower Curtain Hooks: Bobrick B-204-1
 6. Shower Seat: Bobrick B-5181
 7. Towel Bar: Bobrick B-6747 x 18
 8. Mirror: Bobrick B-165 2436
 9. Folding Seat (Changing Area): Bobrick B-5191
 10. Baby Changing Station: Bobrick Koala Care KB101-01

END OF SECTION 10801

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SECTION 15010 - BASIC PLUMBING AND MECHANICAL 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. Installation.

1.3 QUALITY ASSURANCE

- A. The 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. Where there is a conflict between the Drawings and/or Specifications and applicable codes, the more stringent requirements shall apply.
- 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. Where materials and/or methods are not specifically identified in the Drawings and/or Specifications, the Contractor shall provide what

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would be reasonably and customarily expected. The Architect/Engineer will be the sole judge of what is considered reasonable and customary.

- H. Where there is a conflict between the Drawings and/or Specifications and reference drawings and/or specifications included in the Contract Documents (such as equipment vendor drawings), the more stringent requirements shall apply.

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.

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- 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 do not prevent installation and connection of new piping at proper slopes. Notify Architect/Engineer immediately if conditions are found which are substantially different than anticipated.

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, furniture, etc. 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 demolition or 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.
- F. Demolition of equipment, ductwork, piping, conduit, etc. that serves occupied areas outside of the construction limits shall be coordinated with the Owner. Verify areas served by components prior to starting demolition. 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 INSTALLATION

- A. All products shall be installed in strict accordance with the manufacturer's written installation instructions. Where there is a conflict between the Drawings and/or Specifications and manufacturer's installation instructions, the more stringent requirements shall apply.
- B. Install roof-mounted equipment a minimum distance of 10 feet from any roof edge.

END OF SECTION 15010

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SECTION 15050 - BASIC FIRE PROTECTION, PLUMBING AND MECHANICAL 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. Miscellaneous fasteners.
 - 4. Concrete anchors.
 - 5. Polyurethane sealant.
 - 6. Demolition.
 - 7. Cutting and patching.
 - 8. Firestopping and fireproofing.
 - 9. Weatherproofing.
 - 10. Earthwork.
 - 11. Piping installation.
 - 12. Piping joint construction.
 - 13. Equipment connections.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.4 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 MISCELLANEOUS MATERIALS

- A. Structural Steel:

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1. Indoor Locations: ASTM A36, carbon steel plates, shapes and bars with factory-primed or shop-primed finish.
 2. Outdoor Locations: ASTM A36, carbon steel plates, shapes and bars with ASTM A123, hot-dip galvanized finish.
- B. Lightweight Steel Channel:
1. Indoor Locations: ASTM A1011, cold-formed low carbon strip steel, fabricated into slotted struts with manufacturer's standard baked enamel or powder coat finish; with matching fittings.
 2. Outdoor Locations: ASTM A1011, cold-formed low carbon strip steel, fabricated into slotted struts with ASTM A123 and ASTM A153, hot-dip galvanized finish; with matching fittings.
- C. Miscellaneous Fasteners:
1. Indoor Locations: Screws, bolts, nuts and washers of size and type to suit application; zinc-coated carbon steel.
 2. Outdoor Locations: Screws, bolts, nuts and washers of size and type to suit application; hot-dip galvanized carbon steel.
- D. Concrete Anchors:
1. Injectable Adhesive Anchors: Two-component adhesive contained in separate foil packages connected to a single dispensing head; Hilti HIT-RE 100 or equal.
 - a. Indoor Locations: Continuous-thread rod, nut and washer made of zinc-coated carbon steel; Hilti HAS Series or equal.
 - b. Outdoor Locations: Continuous-thread rod, nut and washer made of hot-dip galvanized carbon steel; Hilti HAS Series or equal.
 2. Capsule Adhesive Anchors: Two-component adhesive contained in a single foil capsule, including hole cleaning equipment; Hilti HVU2 or equal.
 - a. Indoor Locations: Continuous-thread rod, nut and washer made of zinc-coated carbon steel; Hilti HAS Series or equal.
 - b. Outdoor Locations: Continuous-thread rod, nut and washer made of hot-dip galvanized carbon steel; Hilti HAS Series or equal.
 3. Wedge Anchors: Externally-threaded stud with mechanical expansion-type wedge; Hilti KWIK Bolt 3 or equal.
 - a. Indoor Locations: Zinc-coated carbon steel.
 - b. Outdoor Locations: Hot-dip galvanized carbon steel.
- E. Polyurethane Sealant: Single-component, non-priming, elastomeric polyurethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT/T/M/A/I/O; BASF MasterSeal NP 1 or equal.

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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 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.
 - 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.

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- 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 WEATHERPROOFING

- A. Install pipe flashing boots for pipes penetrating outdoor vertical surfaces, including but not limited to building walls and equipment cabinets/enclosures. Provide polyurethane sealant under and around outer perimeter of boot base.
- B. Seal all outdoor joints, seams, holes and potential points of water entry with polyurethane sealant.

3.5 EARTHWORK

- A. Excavate trenches to indicated gradients, lines, depths and elevations.
- B. Excavate and shape trench bottoms to provide uniform bearing and support of pipes. Shape subgrade to provide continuous support for bells, joints and barrels of pipes. Remove projecting stones and sharp objects along trench subgrade.
 - 1. For pipes less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe on an undisturbed subgrade.
 - 2. For pipes 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
- C. Place backfill in layers not more than 4 inches in loose depth.
- D. Compact backfill to 98 percent of maximum dry unit weight in accordance with ASTM D698.

3.6 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.

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- 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.
- 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.

3.7 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.

3.8 EQUIPMENT CONNECTIONS

- A. Examine rough-ins for piping systems to verify actual locations of piping connections before equipment installation.

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- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Sizes for piping connections shall be the same size or larger than equipment connections.
- D. Install valves in accessible locations close to connected equipment.

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. Pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Fastener systems.

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. Include rated capacities, operating characteristics and furnished specialties and accessories.

PART 2 - PRODUCTS

2.1 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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2.2 TRAPEZE PIPE HANGERS

- A. Carbon Steel Trapeze Pipe Hangers: MSS SP-69, Type 59, shop or field-fabricated pipe support assembly made from structural carbon steel shapes with MSS SP-58 carbon steel hanger rods, nuts, saddles and U-bolts.

2.3 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded steel stud, for use in hardened portland cement concrete with pull-out, tension and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical Expansion Anchors: Insert wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension and shear capacities appropriate for supported loads and building materials where used.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. 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. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field-fabricate from ASTM A36, carbon steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers and other accessories.
- E. 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.
- F. Install lateral bracing with pipe hangers and supports to prevent swaying.

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- G. Install building attachments within concrete slabs or attach to structural steel or wood framing.
- H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- I. 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.
- 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. Vertical Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon or Alloy Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- E. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top Beam C-Clamps (MSS Type 19): For use under roof installations with bar joist construction, to attach to top flange of structural shape.

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3. Side Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels or angles.
 4. C-Clamps (MSS Type 23): For structural shapes.
 5. Side Beam Clamps (MSS Type 27): For bottom of steel I-beams.
- F. 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 0.028 inch thick.
- G. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- H. Use powder-actuated fasteners or mechanical expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 15062

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SECTION 15077 - SYSTEM IDENTIFICATION

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 labels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Pre-printed, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing, roll-form, designed to wrap completely around pipe.
- C. Pipe Label Contents: Include identification of piping service using same designations as used on Drawings with an arrow indicating flow direction. Do not use abbreviations.
 - 1. Flow Direction Arrows: Integral with piping system service lettering to accommodate both directions.

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2. Lettering Size: Minimum 1-1/2 inches height for systems other than medical gas and vacuum; minimum 1/4 inch height for medical gas and vacuum systems.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 1. Near each valve.
 2. Near each branch connection, excluding short takeoffs for fixtures. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings and inaccessible enclosures.
 4. At access doors and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 20 feet along each run. Reduce intervals to 10 feet in areas of congestion.
 7. At least once in each room or space.
 8. At least once in each story (floor) traversed by vertical piping.
- B. Indoor Pipe Label Schedule: Self-adhesive pipe labels.
 1. Domestic Cold Water Piping:
 - a. Label Content: "DOMESTIC COLD WATER."
 - b. Background Color: Green.
 - c. Letter Color: White.
 2. Domestic Hot Water and Hot Water Return Piping:
 - a. Label Content: "DOMESTIC HOT WATER" or "DOMESTIC HOT WATER RETURN."
 - b. Background Color: Yellow.
 - c. Letter Color: Black.

END OF SECTION 15077

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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. Domestic cold water piping.
 - 2. Domestic hot water piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics and furnished specialties and accessories.

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. 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 and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury or mercury compounds.
- B. Glass Fiber Insulation:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Certainteed.
 - b. Johns Manville.
 - c. Knauf Insulation.
 - d. Owens Corning Insulating Systems, LLC.
 - 2. Preformed Pipe Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied ASJ-SSL.
 - a. Basis of Design: Owens Corning SSL II with ASJ Max 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.
- C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

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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.

2.6 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.

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.

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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.
- 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.

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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:
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 Floor Penetrations: Install insulation continuously through floor penetrations.

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

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- 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.
 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.

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3.6 INSTALLATION OF GLASS FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward-clinched staples at 6 inches 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.

B. 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.

C. 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 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.

B. Domestic Hot Water:

1. NPS 1-1/2 and Smaller: Insulation shall be the following:
 - a. Glass Fiber, Preformed Pipe Insulation: 1 inch thick.

END OF SECTION 15086

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SECTION 15112 - VALVES

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. Bronze ball valves.
 - 2. Bronze check valves.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.4 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance: ASME B31.9 for building services piping valves.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
 - 4. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

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PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- B. Valve Sizes: Same as upstream piping unless otherwise indicated.
- C. Valves installed in potable water piping shall comply with NSF 61.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Valve, Inc.
 - 2. Apollo Valves; Conbraco Industries, Inc.
 - 3. Bray International.
 - 4. Crane Company.
 - 5. FNW; Ferguson Enterprises, Inc.
 - 6. Hammond Valve.
 - 7. Jomar Valve.
 - 8. Lance Valves.
 - 9. Legend Valve.
 - 10. Milwaukee Valve Company.
 - 11. NIBCO, Inc.
 - 12. Red-White Valve Corporation.
 - 13. Watts Water Technologies, Inc.

2.3 BRONZE BALL VALVES

- A. Ball Valves for Potable Water Service, NPS 2 and Smaller:
 - 1. Basis of Design: NIBCO T-585-80-LF.
 - 2. Standard: MSS SP-110.
 - 3. CWP Rating: 600 psig.
 - 4. Body Design: Two-piece.
 - 5. Body Material: Bronze.
 - 6. End Connections: Threaded.
 - 7. Seats: PTFE.
 - 8. Stem: Bronze, blowout-proof.
 - 9. Ball: Bronze.
 - 10. Port: Full.
 - 11. Handle: Plastic-covered, zinc-plated steel lever with 2 inch stem extension.

2.4 BRONZE CHECK VALVES

- A. Check Valves for Potable Water Service, NPS 2 and Smaller:

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1. Basis of Design: NIBCO T-413-Y-LF.
2. Standard: MSS SP-139.
3. CWP Rating: 200 psig.
4. Body Design: Horizontal flow.
5. Body Material: Bronze, with screw-in bonnet.
6. End Connections: Threaded.
7. Seat Disc: PTFE.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 1. Swing Check Valves: In horizontal position with hinge pin level.

END OF SECTION 15112

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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.

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. Include rated capacities, operating characteristics and furnished specialties and accessories.

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 PEX TUBE AND FITTINGS

- A. PEX Tube: ASTM F877, SDR 9 tubing.
- B. PEX Fittings: ASTM F 1807, metal insert-type with copper or stainless steel crimp rings and matching PEX tube dimensions.

2.2 PVC PIPE AND FITTINGS

- A. PVC Pipe: ASTM D1785, Schedule 40.
- B. PVC Socket Fittings: ASTM D2467, Schedule 40.

2.3 PIPING JOINING MATERIALS

- A. PVC Solvent Cement: ASTM D2564. Include primer according to ASTM F656.

2.4 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.

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.
- C. Install PEX tubing with loop at each change of direction of more than 90 degrees.

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3.2 JOINT CONSTRUCTION

- A. Solvent-Cemented 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. Apply primer.
 - 2. PVC Piping: Join according to ASTM D2855.
- B. PEX Tubing Joints: Join according to ASTM F1807.
- C. Dissimilar Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.

3.4 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 PEX tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1 and Smaller: 32 inches with 3/8 inch rod.
- D. Install supports for vertical PEX tubing every 48 inches.
- E. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Larger: 48 inches with 3/8 inch rod.
- F. Install supports for vertical PVC piping every 48 inches.

3.5 CONNECTIONS

- A. Connect domestic water piping to existing systems. Use transition fitting to join dissimilar piping materials.

3.6 IDENTIFICATION

- A. Comply with requirements for identification materials and installation in Section 15077 "System Identification."

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3.7 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.
 - 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.

3.8 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants and hose bibbs.
 2. Open shutoff valves to fully open position.

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3. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
4. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.9 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:
 - 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.

3.10 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. Unions may be used for aboveground piping joints unless otherwise indicated.
- A. Aboveground, domestic water piping, NPS 1 and smaller, shall be one of the following:
 1. PEX tube; PEX tube fittings; and crimped joints.
- B. Aboveground, domestic water piping, NPS 1-1/4 and larger, shall be one of the following:
 1. PVC pipe; PVC socket fittings; and solvent-cemented 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. Pipes, tubes and fittings.
 - 2. Specialty pipe fittings.
 - 3. Floor drains.

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. Include rated capacities, operating characteristics and furnished specialties and accessories.

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. PVC Socket Fittings: ASTM D2665, made to ASTM D3311, drain, waste and vent patterns.

2.2 PIPING JOINING MATERIALS

- A. PVC Solvent Cement: ASTM D2564. Include primer according to ASTM F656.

2.3 TRANSITION FITTINGS

- A. Transition Couplings:
1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 3. Unshielded, Non-Pressure Transition Couplings:
 - a. Standard: ASTM C1173.
 - b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - c. Sleeve Materials:
 - 1) For Cast Iron Soil Pipes: ASTM C564, rubber.
 - 2) For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

2.4 FLOOR DRAINS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Jay R. Smith Manufacturing Company.

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2. Josam Company.
3. MIFAB, Inc.
4. Sioux Chief Manufacturing Company.
5. Watts Water Technologies, Inc.
6. Zurn Industries, LLC.

B. PVC Floor Drains:

1. Standard: ASME A112.6.3.
2. Body Material: PVC.
3. Outlet Connection: Bottom, solvent weld.
4. Adjustable Strainer Housing: PVC.
5. Strainer Material: Nickel Bronze.
6. Top Shape: Round.
7. Top Loading Classification: Light duty.
8. Trap Material: PVC.
9. Trap Pattern: Deep-seal P-trap.

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. Drainage Piping:
 - a. NPS 2 and Smaller: 2 percent (1/4 inch per foot) downward in direction of flow.
 - b. NPS 3 and Larger: 1 percent (1/8 inch per foot) downward in direction of flow.
 2. Vent Piping: 1 percent (1/8 inch per foot) down toward vertical fixture vent or toward vent stack.
- D. Install aboveground PVC piping according to ASTM D2665.
- E. Install underground PVC piping according to ASTM D2321.

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3.2 SPECIALTY INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4 inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1 inch total depression.
 - 3. Install floor drain flashing collar or flange so no leakage occurs between drain and adjoining flooring.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

3.3 JOINT CONSTRUCTION

- A. Solvent-Cemented 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. CPVC Piping: Join according to ASTM D2846 Appendix.

3.4 TRANSITION FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Unshielded, non-pressure transition couplings.

3.5 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.

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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.
5. NPS 6: 4 feet with 3/4 inch rod.
6. NPS 8: 4 feet with 3/4 inch rod.
7. NPS 10: 4 feet with 7/8 inch rod.
8. NPS 12: 4 feet with 7/8 inch rod.

- E. Install supports for vertical PVC piping every 48 inches.

3.6 CONNECTIONS

- A. Connect sanitary drain, waste and vent piping to existing systems. Use transition fitting to join dissimilar piping materials.

3.7 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.
 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.

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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.

3.8 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.

3.9 PIPING SCHEDULE

- A. Aboveground, drainage and vent piping shall be the following:
 1. PVC pipe; PVC socket fittings; and solvent cemented joints.
- B. Underground, drainage and vent piping shall be the following:
 1. PVC pipe; PVC socket fittings; and solvent cemented joints.

END OF SECTION 15150

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SECTION 15411 - PLUMBING FIXTURES

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 the following plumbing fixtures:

1. Water closets.
2. Lavatories.
3. Shower drains.
4. Toilet seats.
5. Flush valves.
6. Faucets.
7. Lavatory piping enclosures.
8. Supply fittings.
9. Waste fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For plumbing fixtures and faucets to include in operation and maintenance manuals.

1.5 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.

PART 2 - PRODUCTS

2.1 WATER CLOSETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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1. American Standard.
2. Briggs Plumbing.
3. Gerber Plumbing Fixtures.
4. Kohler Company.
5. Mansfield Plumbing.
6. Sloan Valve Company.
7. TOTO USA, Inc.
8. Zurn Industries, LLC.

B. Floor-Mounted, Bottom Outlet, Flush Valve Type Water Closets:

1. Standards: ASME A112.19.2/CSA B45.1 and ICC/ANSI A117.1.
2. Material: Vitreous china.
3. Type: Siphon jet.
4. Style: Flushometer valve.
5. Height: Handicapped.
6. Rim Contour: Elongated.
7. Water Consumption: 1.6 gal. per flush.
8. Spud Size and Location: NPS 1-1/2, top.
9. Color: White.

C. Bowl-to-Drain Connecting Fittings: ASME A112.4.3.

2.2 LAVATORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Standard.
2. Briggs Plumbing.
3. Gerber Plumbing Fixtures.
4. Kohler Company.
5. Mansfield Plumbing.
6. Sloan Valve Company.
7. TOTO USA, Inc.
8. Zurn Industries, LLC.

B. Wall-Mounted Lavatories:

1. Standards: ASME A112.19.2/CSA B45.1 and ICC/ANSI A117.1.
2. Material: Vitreous china.
3. Type: For wall hanging.
4. Faucet Hole Punching: Three.
5. Color: White.

2.3 SHOWER DRAINS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Jay R. Smith Manufacturing Company.
2. Josam Company.

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3. MIFAB, Inc.
4. Sioux Chief Manufacturing Company.
5. Watts Water Technologies, Inc.
6. Zurn Industries, LLC.

B. PVC Shower Drains:

1. Standard: ASME A112.6.3.
2. Body Material: PVC.
3. Outlet Connection: Bottom, solvent weld.
4. Adjustable Strainer Housing: PVC.
5. Strainer Material: Nickel Bronze.
6. Top Shape: Round.
7. Top Loading Classification: Light duty.
8. Trap Material: PVC.
9. Trap Pattern: Deep-seal P-trap.

2.4 TOILET SEATS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Standard.
2. Bemis Manufacturing Company.
3. Kohler Company.
4. Mansfield Plumbing.
5. TOTO USA, Inc.
6. Zurn Industries, LLC.

B. Elongated, Open-Front Seats:

1. Standard: IAPMO/ANSI Z124.5.
2. Material: Plastic.
3. Shape: Elongated, open front, with four bumpers.
4. Hinges: Concealed.
5. Hinges: Plastic, self-sustaining, with stainless steel posts and pintles.
6. Seat Cover: Not required.
7. Color: White.

2.5 FLUSH VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Delany Products.
2. Sloan Valve Company.
3. TOTO USA, Inc.
4. Zurn Industries, LLC.

B. Exposed, Diaphragm, Water Closet Flushometer Valves:

1. Standard: ASSE 1037.

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2. Features: Include integral check stop and backflow-prevention device.
3. Material: Brass body with corrosion-resistant components.
4. Finish: Chrome plated.
5. Style: Exposed.
6. Bedpan Washer: Pull-down arm with spray head; where indicated on Drawings.
7. Consumption: 1.6 gal. per flush.
8. Inlet: NPS 1.
9. Outlet: NPS 1-1/2.
10. Operator: Lever handle.

2.6 FAUCETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Standard.
2. Chicago Faucets.
3. Delta Faucet Company.
4. Kohler Company.
5. Moen, Inc.
6. Sloan Valve Company.
7. Speakman Company.
8. Symmons Industries, Inc.
9. T&S Brass and Bronze Works, Inc.
10. Zurn Industries, LLC.

- B. Sensor-Operated Lavatory Faucets:

1. Standard: ASME A112.18.1/CSA B125.1.
2. Body Type: As indicated on Drawings.
3. Body Material: Commercial, solid brass.
4. Finish: Polished chrome-plated.
5. Mounting Type: Deck, exposed.
6. Deck Plate: As indicated on Drawings.
7. Spout: As indicated on Drawings.
8. Spout Outlet: As indicated on Drawings.
9. Minimum Horizontal Dimension From Spout Riser to Spout Outlet (Gooseneck Spouts): 5 inches.
10. Minimum Vertical Dimension From Sink/Lavatory Rim to Spout Outlet (Gooseneck Spouts): 6 inches.
11. Controls: Infrared sensor; include 120/24 VAC plug-in transformer.
12. Mixing Valve: ASSE 1070, thermostatic, adjustable, with inlet check-stops.

- C. Shower Faucets:

1. Description: Single-handle, pressure-balancing mixing valve with hot and cold water indicators, inlet check-stops, adjustable limit stop and shower head.
2. Faucet:
 - a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
 - b. Body Material: Commercial, solid brass.
 - c. Control Cartridge: Ceramic.
 - d. Balancing Piston: Stainless steel.

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- e. Finish: Polished chrome-plated.
 - f. Operation: Single-handle, twist or rotate control.
3. Head:
- a. Standard: ASME A112.18.1/CSA B125.1.
 - b. Type: Hand-held with 60 inch flexible metal hose, 24 inch mounting bar, supply elbow and inline vacuum breaker.
 - c. Shower Head Material: Metallic with chrome-plated finish.

2.7 LAVATORY PIPING ENCLOSURES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Truebro; IPS Corporation.
 - 2. Sloan Valve Company.
 - 3. Zurn Industries, LLC.
- B. Description: One-piece enclosure designed to conceal exposed piping below wall-mounted lavatories and satisfy ADA dimensional requirements.
- 1. Basis of Design: Truebro Lav Shield.
 - 2. Material: Rigid, high-impact PVC, 0.093 inch thickness; factory pre-cut to fit lavatories provided.
 - 3. Fasteners: Stainless steel tamper-resistant screws.
 - 4. Color: White.

2.8 SUPPLY FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. American Valve.
 - 2. BrassCraft Manufacturing.
 - 3. Dearborn Brass; Oatey.
 - 4. McGuire Manufacturing Co., Inc.
 - 5. Watts Water Technologies, Inc.
 - 6. Zurn Industries, LLC.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water supply piping size. Include chrome-plated brass or stainless steel wall flange.
- D. Supply Stops: Chrome-plated brass, quarter-turn ball-type or compression valve with inlet connection matching supply piping and wheel handle.
- E. Risers: Chrome-plated copper tube matching fixture connection size.

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2.9 WASTE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Valve.
 - 2. BrassCraft Manufacturing.
 - 3. Dearborn Brass; Oatey.
 - 4. McGuire Manufacturing Co., Inc.
 - 5. Watts Water Technologies, Inc.
 - 6. Zurn Industries, LLC.
- B. Standard: ASME A112.18.2/CSA B125.2.
- C. Drains: Grid-type with offset or straight tailpiece.
- D. Traps: Chrome-plated, cast brass trap with cleanout plug, seamless brass wall bend, brass slip nuts and chrome-plated brass or stainless steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine rough-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls, floors, cabinets, and counters for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fixtures level and plumb according to rough-in drawings.
- B. Install toilet seats on water closets.
- C. Install supports, affixed to building substrate, for wall-mounted fixtures.
- D. Install lavatory piping enclosures under wall-mounted lavatories that do not have integral piping shrouds.
- E. Install water supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- F. Install traps on fixture outlets.
- G. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

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- H. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning plumbing fixtures, fittings and controls.
- B. Adjust water pressure at faucets and flush valves to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. After installing plumbing fixtures, inspect and repair damaged finishes.
- B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed fixtures and fittings.
- D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 15411

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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 product indicated. Include rated capacities, operating characteristics and furnished specialties and accessories.

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. Comply with SMACNA "HVAC Air Duct Leakage Test Manual" for duct leakage performance and testing.

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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 Steel Sheets: Comply with ASTM A653.
 - 1. Galvanized Coating Designation: G90.
- B. Reinforcement Shapes and Plates: ASTM A36, steel plates, shapes, and bars; galvanized.
 - 1. Where galvanized steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- 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."

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- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports:
 - 1. Supports for Galvanized Steel Ducts: Galvanized steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT CLEANLINESS

- A. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with Advanced Level Cleanliness requirements in SMACNA "Duct Cleanliness for New Construction Guidelines."
- B. During transportation and storage, seal open ends of each individual duct section and fitting to prevent entry of dust and debris into the duct. Duct sections and fittings shall remain sealed until immediately prior to installation.
- C. Store ducts in a clean, dry area where exposure to dust and debris will be minimized.
- D. Before installation, inspect each individual duct section and fitting to ensure that the interior is free from dust and debris. If required, wipe the internal surfaces of ducts and fittings to remove excess dust and debris immediately prior to installation.
- E. Seal all open ends of installed ducts to prevent the entry of dust and debris into the duct.

3.2 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.

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- H. Route ducts to avoid passing through electrical equipment rooms.
- I. 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.
- J. Do not install ducts directly above electrical equipment such as panelboards and transformers.

3.3 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."

3.4 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.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- 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. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. 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.

3.5 DUCT SCHEDULE

- A. General Service Exhaust Ducts:
 - 1. Material: Galvanized steel.
 - 2. Pressure Class: Positive 2 inches wg.

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3. Seal Class: A.
4. Leakage Class (CL) for Rectangular: 6.
5. Leakage Class (CL) for Round: 3.

B. Elbow Configuration:

1. Rectangular 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.
2. Round 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.

C. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. 45 degree entry.
2. Round Duct: Comply with SMACNA "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. 45 degree entry.

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. Manual volume dampers.
 - 2. Flexible ducts.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For duct accessories to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70 "National Electrical Code," and marked for intended location and application.
- B. 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."
- C. 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 MANUAL VOLUME DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance, Inc.; Mestek, Inc.
2. Arrow United Industries; Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries, Inc.
5. NCA Manufacturing, Inc.
6. Pottorff.
7. Ruskin Company.
8. Safe Air of Illinois; Dowco Products Group.
9. United Enertech.

B. Round Dampers, Galvanized Steel:

1. Basis of Design: Ruskin MDRS25.
2. Frame: Roll-formed, 0.040 inch thick galvanized steel, 6 inches long.
3. Blade: Single-piece butterfly-type, 0.040 inch thick galvanized steel.
4. Axle: Single plated steel shaft mechanically fastened to blade, continuous through entire damper frame diameter, 3/8 inch.
5. Bearings: Molded synthetic or oil-impregnated bronze alloy.
6. Hand Quadrant: Locking-type with 2 inch stand-off bracket.

2.2 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anco Products; Retek Engineering Solutions.
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.

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- 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 DUCT ACCESSORY CLEANLINESS

- A. Protect duct accessories from moisture, construction debris and dust, and other foreign materials. Comply with Advanced Level Cleanliness requirements in SMACNA "Duct Cleanliness for New Construction Guidelines."
- B. During transportation and storage, seal open ends of each duct accessory to prevent entry of dust and debris into the duct accessory. Duct accessories shall remain sealed until immediately prior to installation.
- C. Store duct accessories in a clean, dry area where exposure to dust and debris will be minimized.
- D. Before installation, inspect each individual duct accessory to ensure that the interior is free from dust and debris. If required, wipe the internal surfaces of duct accessories to removed excess dust and debris immediately prior to installation.
- E. Seal all open ends of installed duct accessories to prevent the entry of dust and debris into the duct.

3.2 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. Install manual volume dampers at points on supply, return, exhaust and outside air systems where branches extend from larger ducts.
- D. Set manual volume dampers to fully-open position before testing, adjusting and balancing.
- E. Mark the locations of manual volume dampers using orange marking paint or orange flagging tape. Marking paint, if used, shall be sprayed on the bottom and sides of ducts at all damper locations in easily viewable locations. Flagging tape, if used, shall be tied to each damper hand quadrant and shall be of a length so as to hang a minimum of 6 inches below the bottom of the duct.
- F. Connect diffusers and grilles to ducts with flexible duct using straps plus tape.
- G. Connect flexible ducts to metal ducts using straps plus tape.

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3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

B. Duct accessories will be considered defective if they do not pass tests and inspections.

END OF SECTION 15820

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SECTION 15838 - FANS

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. Ceiling-mounted exhaust fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99 "Standards Handbook."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics and furnished specialties and accessories.
- B. Shop Drawings: 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.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fans to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70 "National Electrical Code," and marked for intended location and application.
- B. Listing: Fans shall be listed and labeled in accordance with UL 705 "Standard for Power Ventilators."

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- C. AMCA Compliance: Fans shall be factory tested according to AMCA 210 "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating," shall have performance certified in accordance with AMCA 211 "Certified Ratings Program - Product Rating Manual for Fan Air Performance" and shall be licensed to bear the AMCA Certified Ratings Seal.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTED EXHAUST FANS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Acme Engineering & Manufacturing Corporation.
 2. American Coolair Corporation.
 3. Carnes Company.
 4. Greenheck Fan Corporation.
 5. Loren Cook Company.
 6. PennBarry.
 7. Twin City Fan Company.
- B. Housing: Galvanized steel.
- C. Fan Wheel: Centrifugal, directly mounted on motor shaft; statically and dynamically balanced.
1. Blade Material: Plastic.
 2. Blade Type: Forward curved.
- D. Grille: Plastic.
- E. Accessories:
1. Variable Speed Controller: Solid state dial controller to vary speed of motor, furnished loose for field installation.
 2. Backdraft Damper: Aluminum, mounted in fan outlet; factory set to close when fan stops.

2.2 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA Certified Ratings Seal.

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fans level and plumb.
- B. Suspend ceiling-mounted fans from structure; use steel wire or metal straps.
- C. Install fans with clearances for service and maintenance.
- D. Label fans according to requirements specified in Section 15077 "System Identification."

3.2 CONNECTIONS

- A. Install ducts adjacent to fans to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Verify that shipping, blocking and bracing are removed.
 - 2. Verify that fan is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 15838

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SECTION 15856 - GRAVITY VENTILATORS

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. Spun aluminum ventilators.

1.3 PERFORMANCE REQUIREMENTS

- A. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1 "Ventilation for Acceptable Indoor Air Quality."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics and furnished specialties and accessories.
- B. Shop Drawings: For gravity ventilators. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

1.5 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 SPUN ALUMINUM VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acme Engineering & Manufacturing Corporation.

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2. American Coolair Corporation.
3. Carnes Company.
4. Greenheck Fan Corporation.
5. Loren Cook Company.
6. PennBarry.
7. Twin City Fan Company.

B. Hoods:

1. Top: Removable, spun-aluminum.
2. Internal Support Structure: Aluminum or galvanized steel.
3. Base: Square, one-piece, welded aluminum or galvanized steel.
4. Bird Screen: Aluminum, 1/2 inch square mesh or flattened, expanded aluminum, 3/4 by 0.050 inch thick.
5. Curb Seal: Closed cell neoprene.

C. Roof Curbs: Factory-fabricated, straight-sided, minimum 0.052 inch thick galvanized steel with integral base plate and continuously welded and mitered corners; 1-1/2 inch wood nailer; 1-1/2 inch thick rigid fiberglass insulation adhered to inside walls; include internal reinforcement as required to suit load.

1. Overall Height: 18 inches.
2. Pitch: Match roof pitch for sloped roofs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install gravity ventilators level, plumb and at indicated alignment with adjacent work.
- B. Install gravity ventilators with clearances for service and maintenance.
- C. Label gravity ventilators according to requirements specified in Section 15077 "System Identification."
- D. Repair damaged finishes. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

END OF SECTION 15856

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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.
- 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.

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 TOLERANCES

- A. Set system air flow rates and water flow rates within the following tolerances:
 - 1. Air Flow Rates: Plus or minus 10 percent of design values.

3.7 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.

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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.
 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. Terminal units.
 6. Balancing devices.
 7. Position of balancing devices.
- E. Exhaust Fan Test Reports:
1. Fan Data:
 - a. Fan number.
 - b. Manufacturer.

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- c. Model number.
- d. Serial number.
- e. Location.
- f. Area served.
- g. Air flow (design and actual).
- h. Fan rpm (design and actual).
- i. Total static pressure (design and actual).

2. Motor Data:

- a. Motor manufacturer.
- b. Motor horsepower.
- c. Motor rpm.
- d. Motor frame type.
- e. Motor service factor.
- f. Motor volts and phase.
- g. Motor full load amperage.
- h. Voltage for each phase (actual).
- i. Amperage for each phase (actual).

F. Air Distribution Test Reports:

- 1. Air flow at each supply diffuser (design and actual).
- 2. Air flow at each return grille (design and actual).
- 3. Air flow at each exhaust grille (design and actual).

G. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type.
- b. Manufacturer.
- c. Model number.
- d. Serial number.
- e. Calibration date.

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.
- C. If submittal sheet from a catalog is submitted and shows multiple items or multiple classifications or types of the same item, the item submitted SHALL BE CLEARLY MARKED with a red arrow pointing to the item submitted. Submittals with more than one item on a sheet with

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out the submitted item being CLEARLY MARKED as the item submitted, will be returned as "revise and resubmit".

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. 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.
- D. Prepare written reports of all tests and inspections required by the individual work sections.
- E. Initial Reports: Submit one (1) electronic PDF copy of each test and inspection report within seven days' of completing the test or inspection for review by the Engineer. Handwritten initial reports are acceptable.
 - 1. Allow seven days for the Engineer's review of the initial report of each test and inspection.
- F. Final Reports: Prepare typed final reports of all tests and inspections. Handwritten final reports are not acceptable. At the completion of the project, prepare a compiled report of all tests and inspections performed for the electrical systems. Tabulate and divide the reports into separate sections organized by the individual work section that required the test or inspection. In addition to individual test and inspection reports, include the following data:
 - 1. Title page with report date.
 - 2. Project name.
 - 3. Project location.
 - 4. Architect's name and address.
 - 5. Engineer's name and address.
 - 6. Contractor's name and address.
 - 7. Table of contents.
- G. Submit one (1) electronic PDF copy and one (1) hard copy bound in a three-ring binder of all Final Reports as part of the closeout documents specified in Division 01 Section "Project Closeout".
 - 1. The cover and the end of the binder shall be identified with the project name.

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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.

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.

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- 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 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.

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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 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

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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.
- 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.

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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.
 - 1. Raceways to Be Removed: Remove raceways (conduit and wire) of circuits indicated to be removed back to source.
 - 2. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 3. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 4. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If raceways or equipment to remain are damaged in appearance or are unserviceable as a result of demolition activities, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- D. Repair and/or patch all openings in building assemblies (walls, floors, ceilings, roofing, etc.) where electrical components are demolished. Use similar materials as existing construction.

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.

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- 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.

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.
 - 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. Provide one coat of concrete primer and two coats of concrete paint. 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.
- C. Paint concrete bases according to the requirements specified in Division 9 Section "Painting." Confirm color(s) with the Owner prior to application.

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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.
- 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. Use of proper hydraulic tool and dies are required. Crimp splices without size specific dies are unacceptable. Manufacture:
 - a. Burndy Hylink Long barrel splice with proper hydraulic tool and dies
 - b. Equal meeting performance standard of specified manufacture
 - 2. The splice shall be covered in a clear cold shrink silicon sleeve that allows inspection of the splice.

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Manufacture:

- a. Burndy Type CCSC Cold Shrink Silicon tubing
- b. Equal meeting performance standard of specified manufacture

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).

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- 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.
- 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.

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- 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 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 clear 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 with specifically sized dies 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.

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- 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.

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.

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3.9 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

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. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. LFMC: Liquid tight flexible metal conduit.
- D. PVC: Polyvinyl Chloride.

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
- D. Source quality-control reports.

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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. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- E. 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.
- F. FMC: Comply with UL 1; zinc-coated steel. All FMC and fittings shall be UL listed as suitable for grounding.
- G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360 and shall be UL listed as suitable for grounding.
- H. 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.
 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.
- I. 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

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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. 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).

- D. 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, WALL DUCTS, FLOOR DUCTS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Mono-Systems, Inc.
 - 4. Hubbell, Inc
 - 5. Legrand

- 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.

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- F. Wireway shall be listed as a grounding path and meet the requirements of NEC 250.118 (13) or (14)

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 raceways shall be listed as a grounding path and meet the requirements of NEC 250.118 (14).
- C. 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.
 - d. Hubbell, Inc.
- D. 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.
 - d. Hubbell, Inc.
 - 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.
 - 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.

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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. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover. Boxes shall be 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
- I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- J. Device, Outlet, Data/Comm and junction box 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:
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.

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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. **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. All raceways in a MRI room: ARC.
 4. 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. Gymnasiums.
 5. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 6. All feeders over 600 volts: GRC or IMC.
 7. All power and/or control/low voltage conduits to and between all radiology equipment, and conduit to and in all patient care areas shall be EMT or GRC. Conduit installed underground below the building shall be PVC-coated rigid steel conduit.
 8. All branch circuit conduit shall be EMT or GRC. Branch circuit conduit that is run under the building slab shall be PVC-coated rigid steel conduit.
 9. Connection to Pumps, Generators, Daytanks: LFMC.
 10. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.
 11. Damp or Wet Locations: GRC or IMC.
 12. Conduit installed within 1 ½" of metal corrugated sheet roof decking shall be IMC or GRC.
 13. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 in institutional and commercial kitchens and damp or wet locations.
 14. All underslab conduit to healthcare radiology equipment (including, but not limited to all X-Ray equipment, Linear Accelerators, PET machines, CT machines, MRI's, etc.): PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
- B. Minimum Raceway Size: 3/4-inch trade size. 1/2" minimum FMC less than 6 foot long to light fixtures.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression steel fittings. Comply with NEMA FB 2.10.

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- 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- D. Install nonferrous conduit or tubing for circuits operating above 60 Hz. or inside a MRI enclosure. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- 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. Use long radius bends where possible on all medium voltage or shielded cable runs.
- H. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- I. 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.
- J. All metallic raceways shall be of ¾" minimum size.
- K. All non-metallic raceways shall be of 1" minimum size.
- L. 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.
- M. In no case shall any conduit be filled to over 40 percent of its cross-sectional area.

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- N. Fasten conduit securely to outlets, junctions and pullboxes to ensure firm electrical contact.
- O. Support conduit within 12 inches of box or enclosure to which attached. All supports shall be UL listed and specifically made for the purpose.
- P. Avoid condensation pockets in installations. Keep conduit, fittings, and boxes free from foreign matter, before, during and after installation.
- Q. Not more than one (1) exposed conduit shall be run down to an exposed wall switch or outlet box.
- R. 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.
- S. 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.
- T. Support conduit risers exposed in wire shafts at each floor level with approved U-clamp hangers.
- U. Install empty conduit for future use as indicated on the drawings. Conduit shall be complete with pullwire or rope, junction and outlet boxes.
- V. Do not install conduit laid across roof deck, run conduit horizontally below roof deck and stub up where needed to feed equipment. Conduit may be run on raised roof racks constructed of galvanized steel or on mechanical equipment racks.
- W. Conduit shall not be supported from metal roof deck or from ceiling support wires.
- X. Provide pitchpocket where conduit penetrates roof.
- Y. All conduits shall be installed as high as possible in the ceiling cavity. Coordinate all conduit installation with ductwork, sprinkler, and/or mechanical piping.
- Z. 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.
- AA. 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.
- BB. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades and architectural elevations.
- CC. Conduits shall not cross pipe shafts or ventilating duct openings.
- DD. Support riser conduit at each floor level with clamp hangers.

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- EE. 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.
- FF. Arrange all conduits to maintain headroom and present a neat appearance.
- GG. 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.
- HH. Raceways shall not be installed in or under concrete floor slabs without the prior approval of the A/E.
- II. Raceways Embedded in Slabs:
 - 1. Conduit **shall not** be installed in slabs.
- JJ. 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.
- KK. 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.
- LL. 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.
- MM. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- NN. Raceway Terminations: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- OO. 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.
- PP. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- QQ. 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.
- RR. 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.

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- SS. 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.
- TT. Surface Raceways:
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.
- UU. 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.
- VV. 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.
- WW. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- XX. 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.

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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.

- YY. 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.

- ZZ. 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.

- AAA. 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.

- BBB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

- CCC. Locate boxes so that cover or plate will not span different building finishes.

- DDD. 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.

- EEE. Set metal floor boxes level and flush with finished floor surface.

- FFF. All screws into any junction box shall be installed into a pre-drilled and pre-tapped hole and the screws shall not be self-tapping. The screws shall be flat or rounded at the end of the thread opposite the head of the screw so as to avoid cutting or puncturing the cable insulation. Screws shall be installed in locations where they will not contact the conductors.

3.4 PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies and all foundation or footing penetrations. Sleeves shall be a minimum of at least $\frac{3}{4}$ " around outside diameter of conduits over 2".

3.5 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. All firestopping assemblies shall be UL listed for the exact application. Wall or floor preparation for the firestopping method shall exactly meet the UL listing criteria.

3.6 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.

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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.
- B. This section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to related work specified herein.

1.2 SUMMARY

- A. The extent of wiring device work is indicated by the Drawings. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.
- B. Types of electrical wiring devices in this section include the following:
 - 1. Connector bodies.
 - 2. Receptacles.
 - 3. Ground-fault circuit interrupters.
 - 4. Twist-locking receptacles.
 - 5. Receptacles with integral surge-suppression units.
 - 6. Weather-resistant receptacles.
 - 7. Switches.
 - 8. Wallplates.
 - 9. Wall-dimmers.
 - 10. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

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.

1.4 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wiring devices, of types, sizes, and ratings required.
- B. NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.
- C. UL Compliance: Comply with applicable requirements of UL 20, 486A, 498 and 943 pertaining to installation of wiring devices. Provide wiring devices which are UL listed and/or labeled.

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- D. NEMA Compliance: Comply with applicable portions of NEMA Stds Pub/No. WD 1, "General Color Requirements for Wiring Devices" "General-Purpose Wiring Devices," WD 2, "Semiconductor Dimmers for Incandescent Lamps," WD3, "Alternating-Current general use Snap Switches," WD 5, "Specific-Purpose Wiring Devices, WD 6, "Wiring Devices—Dimensional Specifications".

1.5 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations and ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 - 1. Hubbell Incorporated.
 - 2. Pass & Seymour/Legrand.
 - 3. ArrowHart, Eaton Corporation
- B. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Stds Pub/No. WD 1.
- B. 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.
- C. Comply with NFPA 70.
- D. Install wiring devices after wiring work is completed.
- E. Device colors shall be as follows:
 - 1. Normal power device receptacles, dimmers and light switches – Gray.
- F. Receptacles, Straight Blade – Non exam room
 - 1. All receptacles shall be heavy duty specification grade and listed and labeled for such use.
 - 2. All receptacles installed outdoors and in other wet or damp locations shall be "weather-resistant" type and listed and labeled for such use.
 - a. All indoor wet location receptacles shall be installed using wet rated covers.
 - 3. Receptacles requiring a current or voltage rating or configuration different from convenience receptacles shall be as indicated on the Drawings.

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4. Provide other receptacles with quality, material and workmanship at least equal to that specified for duplex convenience receptacles.
 5. Auto-ground clips shall not be acceptable for receptacle grounding.
- G. Receptacles, Twist Lock
1. All twist lock receptacles shall be single receptacle, grounding type, and listed and labeled for such use.
 2. All twist lock receptacles installed outdoors and in other wet or damp locations shall be "weather-resistant" type and listed and labeled for such use.
 3. Provide twist lock receptacles as required above, 2-pole, 3-wire, grounding, with green equipment ground screw, ground terminals and poles internally connected to mounting yoke unless noted otherwise, 20-amperes, 125-volts, with metal plaster ears; design for side wiring with wire clamp, with NEMA configuration L5-20R unless otherwise indicated.
 4. Twist lock receptacles requiring a current or voltage rating or configuration different from above shall be as indicated on the Drawings.
 5. Provide other receptacles with quality, material and workmanship at least equal to that specified for the above twist lock receptacles.
 6. Auto-ground clips shall not be acceptable for receptacle grounding.

2.3 STRAIGHT-BLADE RECEPTACLES - Heavy Duty Specification Grade

- A. Heavy Duty Specification Grade, Duplex Convenience Receptacles: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
- B. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
- C. Pass & Seymour PS5362 or equal by listed manufacturer.

2.4 GFCI RECEPTACLES - Heavy Duty Specification Grade

- A. General Description:
 1. Straight blade, feed -through type.
 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 498, UL 943 Class A, and FS W-C-596.
 3. Configuration: Duplex, NEMA 5-20R.
 4. Trip Current: 5 plus or minus 1 milliampere.
 5. Trip Speed: 0.025 second maximum.
 6. GFCI receptacle shall be Spec grade.
 7. Self testing
 8. Feed-thru, capable of protecting connected downstream receptacle on a single current, front-accessible test, and reset pushbuttons.
 9. Devices shall have the Self-testing and notification feature
 10. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
 11. Receptacles requiring a current or voltage rating or configuration different from duplex GFCI convenience receptacles shall be as indicated on the Drawings.
 12. Provide other receptacles with quality, material and workmanship at least equal to that specified for duplex GFCI convenience receptacles.
 13. All outdoor receptacles shall be installed in "weather resistant in use" covers

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- B. Specification Grade, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 and FS W-C-596
- C. Pass & Seymour 2097 or equal by listed manufacturer.

2.5 SINGLE RECEPTACLES

- A. Provide single straight-blade receptacles, ratings and NEMA configurations as listed on drawings, grounding type, with green hexagonal equipment ground screw, ground terminals and poles internally connected mounting yoke, with metal plaster ears; design for back wiring with spring loaded, screw activated pressure plate.
- B. Pass & Seymour PS5361 or equal by listed manufacturer.

2.6 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

2.7 SPECIALTY OR DEDICATED RECEPTACLES

- A. Provide as specified on drawings or in equipment literature.

2.8 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Provide totally enclosed, 20 Ampere, 120/277 Volt, quiet AC general-use snap switches.
- C. Switches shall be single pole, double pole, three-way, four-way, locking or with pilot light as indicated on the drawings.
- D. Switches shall be specification grade.

2.9 WALL-BOX DIMMERS

- A. Dimmer Switches: shall be 0-10V and have an on/off and up and down control.
- B. LED Lamp Dimmer Switches: Modular; Fully compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 5 percent of full brightness or to a level indicated.

2.10 WALL PLATES

- A. All wiring devices shall be provided with standard size one-piece cover plates of suitable configuration for the number and type of devices to be covered
- B. All cover plates shall be stainless steel except as specifically noted

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- C. Metallic cover plates shall be fabricated of corrosion-resistant #302 stainless steel, having a nominal thickness of .04", and a brushed or satin finish. Screws securing the plates shall have flush (when installed) heads with finish to match plates. Metallic cover plates shall meet all requirements of the National Electrical Code and Federal Specifications

- D. Dry Location wall plates: Provide wall plates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated. Select plates which mate and match wiring devices to which attached.
 - 1. Plate-Securing Screws: Screws securing the plates shall have flush (when installed) heads with finish to match plates.
 - 2. Cover plates shall be constructed of corrosion-resistant #302/304 stainless steel. The plates shall have a minimum nominal thickness of .032", and a brushed or satin finish. Stainless steel plates shall be shipped with a protective film.
 - 3. Provide all wall receptacles with a Caddy No. RLC leveler and retainer.
 - 4. All wall plates for devices in block walls shall be oversize plates.

- E. Wet Location, Weatherproof Cover Plates for 15 or 20 amp receptacles: NEMA 250, complying with Type 3R "in use type", die-cast aluminum, listed "extra-duty" with lockable cover. Cover shall be continuously waterproof with cable plugged in. Covers shall be Intermatic WP1250MVXD for vertical installations or WP1010HMXD for horizontal installation; or approved equal.

- F. Damp Location, unless noted otherwise shall meet the requirements of wet location cover plates.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices to fulfill project requirements.
 - 1. Where adjacent to doors, coordinate with architectural drawings to ensure switches are installed on strike side of door.
 - 2. Locate switches 48 inches (centerline) above finished floor elevation unless otherwise indicated. Group adjacent switches under single, multigang wall plates.
 - 3. Long dimension of switches shall be vertical unless otherwise indicated or required.
 - 4. Locate receptacles 18 inches (centerline) above finished floor elevation unless otherwise indicated.
 - 5. Long dimension of receptacles shall be vertical unless otherwise indicated or required.

- B. Location of special receptacles:
 - 1. Provide GFCI receptacles within 6'0" of any sink and where shown on drawings.
 - 2. Provide GFCI receptacles in any kitchen area and where shown on drawings.
 - 3. Provide poke-through assemblies where floor mounted receptacles are called for on all above grade floor slabs.
 - 4. Provide Cast floor boxes on all slabs on grade.

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C. Coordination with Other Trades:

1. Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.
2. Refer to Architectural drawings for possible wall elevations showing exact location requirements of devices.
3. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
4. 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.
5. 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.
6. Install wiring devices after all wall preparation, including painting, is complete.
7. Review approved casework/millwork drawings prior to rough-in of devices in applicable areas. Coordinate receptacle, switch, and data outlets to be of uniform height over casework/millwork. In all cases, devices and covers shall clear backspashes by at least 2"

D. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails and shall be at least 6".

E. Device Installation:

1. Replace all devices that have been in temporary use during construction or that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
10. Install a 120 Volt "weatherproof in use" cover for the duplex receptacle adjacent to each appliance mounted on the roof, which is capable of being serviced from the roof.
11. Install other devices as indicated on the Drawings. Check Architectural drawings for elevations that may show exact device locations.

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12. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices.
 - a. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B.
 - b. Use properly scaled torque indicating hand tool.
 13. 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
- F. Receptacle Orientation:
1. Install receptacles with ground pin of vertically mounted receptacles up and on horizontally mounted receptacles to the left.
- G. Protection of Wall Plates and Receptacles
1. Protect wiring devices and wallplates during construction.
 2. Cover boxes during painting and drywall operations.
 3. At time of Substantial Completion, replace those items which have been damaged or painted including those burned and scored by faulty plugs.
- H. Dimmers:
1. Install dimmers within terms of their listing.
 2. Verify that dimmers used for fan speed control are listed for that application.
 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with "Electrical Identification."

3.3 FIELD QUALITY CONTROL

- A. Prior to energizing circuitry, test wiring for electrical continuity, and for short-circuits.
- B. Subsequent to completion of installation of wiring devices, energize circuitry and demonstrate capability and compliance with requirements.
- C. Test all wiring devices to demonstrate compliance with requirements.
- D. Ensure proper polarity of connections is maintained.
- E. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- F. Where possible, correct compliance with requirements.
- G. Where possible, correct malfunctioning units at project site, then retest to demonstrate compliance; otherwise remove and replace with new units and retest.

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- H. Perform tests and inspections and prepare test reports.
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

- I. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 114 to 126 V.
 - 2. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 3. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 4. The 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.

- J. Wiring device will be considered defective if it does not pass tests and inspections.

- K. Prepare test and inspection reports.

3.4 GROUNDING

- A. Provide equipment grounding connections for wiring devices including switches, unless otherwise indicated.

- B. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.

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 ground clamps for grounding conductors to underground grounding rods.
- G. 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.
- H. Provide grounding system per the Drawings and Article 250 of the NEC. Provide green equipment grounding conductor for all electrical raceways.
- I. Connect grounding electrode conductors to building steel using a suitable grounding clamp, lightning protection ground system and 2-3/4" x 10'-0" copper clad steel ground rods driven not less than six feet apart.
- J. Use minimum #2 AWG copper conductor for communications service grounding conductor. Leave 10 feet of slack conductor at terminal board.
- K. 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
- L. Connect grounding electrode conductors to 1-inch diameter, or greater, metallic cold water pipe using a suitably sized ground clamp.
- M. 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.
- N. 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.
- O. Provide clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity.
- P. 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.
- Q. 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.
- R. 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.

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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.

- S. Provide a #10 AWG insulated continuous copper bonding conductor in ¾" conduit between all critical branch and normal branch panelboard grounding terminal busses, new or existing, feeding receptacles or equipment in patient care areas. Bonding conductors shall be installed per requirements of NEC 517.14. The bonding conductor and conduit shall be identified per the requirements indicated in the Electrical Identification specification section.

- T. 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 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.

- U. 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.

- V. 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

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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.

6. In all patient care areas as defined by NEC and NFPA 99 provide a report by an independent testing agency that grounding is in compliance. The grounding system shall be tested and documented in accordance with NFPA 99. Include both voltage measurements and impedance measurements. Testing method of this compliance shall be in compliance with the authority having jurisdiction.
- 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).
- 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
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. LED: Light-emitting diode
- D. LER: Luminaire efficacy rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. 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:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Energy-efficiency data.
 - 4. Life, output (lumens, CCT, and CRI)

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5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. LED fixtures shall 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.

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.
- 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.

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- G. 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 fixtures: 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.

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.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

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- B. LED Fixtures: Comply with UL 1598 and UL 8750. Where LER is specified, test according to NEMA LE 6 as applicable.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. 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.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- F. 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 minimum unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
- G. Factory-Applied Labels: Comply with UL 1598. Labels shall be located where they will be readily visible to service personnel,
- H. 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.
- I. 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.
- J. LED fixtures shall have integral drivers.
- K. 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 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. LEDs, 50,000 hours minimum rated lamp life.
 - 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

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- a. Battery: Sealed, maintenance-free, nickel-cadmium type.
- b. Charger: Fully automatic, solid-state type with sealed transfer relay.
- c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lighting unit 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.

2.4 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 lighting unit 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.

2.5 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.

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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.
- B. Lighting Fixtures Supports in Suspended Acoustical Ceiling: 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 a lay-in fixture (1'x4', 2'x2' and 2'x4') to the structural deck above.
 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. Provide a fixture support wire, independent of the ceiling system, from the fixture to the structural deck
- C. Lighting Fixtures Support in Suspended Gypboard Ceiling: Use grid as a support element.
1. Fasten lighting fixtures to mounting flange at or near each fixture corner with screws and fixture clips that are UL listed for the application.
- D. Recessed Downlight Supports in Suspended Acoustical Ceiling:
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.

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- 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 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."

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 LED lighting units for a period of one year following the Date of Substantial Completion.
- D. At Date of Substantial Completion, replace LED lighting units 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 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.

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3.6 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