



COUNTY OF EL PASO
County Purchasing Department
500 East San Antonio, Suite PU500
El Paso, Texas 79901
(915) 546-2048
(915) 546-8180 Fax

Notice to Interested Parties

Sealed bids will be received at the County Purchasing Department, 500 E. San Antonio, Suite PU500, El Paso, Texas 79901 before 2:00 p.m., **Tuesday, July 3, 2007** to be opened at the County Purchasing Office the same date for **Construction of Abandoned Motor Vehicle Building for Sheriff's Office.**

Bids must be in a sealed envelope and marked:

"Bid to be opened July 3, 2007

Construction of Abandoned Motor Vehicle Building for Sheriff's Office

Bid #07-089"

Any questions or additional information required by interested vendors must be submitted in writing to the attention of the County Purchasing Agent before Tuesday, June 26, 2007, at 12:00 p.m. Questions can be faxed to (915)-546-8180.

Said contract shall be let to the lowest responsible bidder, and the **COMMISSIONER'S COURT RESERVES THE RIGHT TO REJECT ANY AND ALL BIDS AND WAIVE TECHNICALITIES.** Only bids that conform to specifications will be considered. Faxed bids will not be accepted. Successful bidder shall not order items or services until a Purchase Order is received from the County Purchasing Office. Payment will not be made on items delivered without a Purchase Order. Contract will be awarded by lump sum or line item, whichever is in the best interest of the County.

In order to remain active on the El Paso County Vendor list, each vendor receiving this bid must respond in some form. Vendors submitting a bid must meet or exceed all specifications herein. Vendors submitting a no bid must submit their reason in writing to the El Paso County Purchasing Department.

If the bid totals more than \$100,000.00, the bidder shall furnish a certified cashier's check made payable to the order of El Paso County or a good and sufficient bid bond in the amount of 5% of the total contract price, executed with a surety company authorized to do business in the State of Texas. The bid bond must be included with the bid at the time of the opening.

PITI VASQUEZ
County Purchasing Agent

BIDDING SCHEDULE

To: El Paso County, Texas

I or we agree to furnish the following described equipment, supplies, or services for the prices shown in accordance with specifications listed below or attached. By execution of this bid, I hereby represent and warrant to El Paso County that I have read and understood the Bid Documents and the Contract Documents and this bid is made in accordance with the Bid Documents.

Please quote prices and discounts on the following items:

F. O. B. El Paso County

Description – Bid # 07-089 Construction of Abandoned Motor Vehicle Building for Sheriff's Office Vendor must meet or exceed specifications
TOTAL COST
\$
Please do not include tax, as the County is tax-exempt. We will sign tax exemption certificates covering these items. Please submit one (1) original copy and two (2) copies of your bid.

_____ Company	_____ Address
_____ Federal Tax Identification No.	_____ City, State, Zip Code
_____ CIQ Document Number	_____ CIQ Sent Date
_____ Representative Name & Title	_____ Telephone
_____ Fax Number	_____ E-mail
_____ Signature	_____ Print

*****THIS MUST BE THE FIRST PAGE ON ALL BIDS*****

COUNTY OF EL PASO, TEXAS

Solicitation Check List

Construction of Abandoned Motor Vehicle Building for Sheriff's Office Bid #07-089

THIS CHECKLIST IS PROVIDED FOR YOUR CONVENIENCE

- _____ Responses should be delivered to the County Purchasing Department by 2:00 p.m., Tuesday, July 3, 2007. Did you visit our website (www.epcounty.com) for any addendums?
- _____ Did you sign the Bidding Schedule?
- _____ Did you sign the "Certifications Regarding Lobbying, Debarment, Suspension and Other Responsibility Matters; Drug-Free Workplace Requirements; Federal Debt Status, and Nondiscrimination Status And Implementing Regulations" document?
- _____ Did you sign the "Consideration of Insurance Benefits" form?
- _____ Did you file a copy of the completed Conflict of Interest Questionnaire (Form CIQ) with the El Paso County Clerk (in person or by mail to 500 E. San Antonio, Suite 105, El Paso, TX 79901 or by fax to 915-546-2012 attention Joann) and write the confirmation number given as proof of filing on your bidding schedule? Please include the completed and signed form with your response whether a relationship exists or not.
- _____ If your bid totals more than \$100,000, did you include a bid bond?
- _____ Did you provide one original and two (2) copies of your response?
-

Construction of Abandoned Motor Vehicle Building for Sheriff's Office

Bid #07-089



**Opening Date
Tuesday, July 3, 2007**

FOR SPECIFICATIONS SEE THE MANUAL:

Copies of the specifications may be obtained at the County Purchasing Department at the address given above for a \$50 non-refundable fee. Any additional information required by interested vendors must be submitted in writing to the attention of the County Purchasing Agent before Tuesday, June 26, 2007 at 12:00 p.m.

COUNTY OF EL PASO, TEXAS

CERTIFICATIONS REGARDING LOBBYING, DEBARMENT, SUSPENSION AND OTHER RESPONSIBILITY MATTERS; DRUG-FREE WORKPLACE REQUIREMENTS; FEDERAL DEBT STATUS, AND NONDISCRIMINATION STATUS AND IMPLEMENTING REGULATIONS*

Instructions for the certifications:

General Requirements

The County of El Paso, Texas is required to obtain from all applicants of federal funds or pass-through certifications regarding federal debt status, debarment and suspension, and a drug free workplace. Institutional applicants are required to certify that they will comply with the nondiscrimination statutes and implementing regulations.

Applicants should refer to the regulations cited below to determine the certifications to which they are required to attest. Signature of the form provides for compliance with certification requirements under 21 CFR part 1405, "New Restrictions on Lobbying," 21 CFR part 1414, Government wide Debarment and Suspension (Non-procurement), Certification Regarding Federal Debt Status (OMB Circular A-129), and Certification Regarding the Nondiscrimination Statutes and Implementing Regulations. The certifications shall be treated as a material representation of fact upon which reliance will be placed when the County of El Paso determines to award the covered cooperative agreement

1. LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented in 21 CFR part 1405, for persons entering into a cooperative agreement over \$100,000, as defined at 21 CFR Part 1405, the applicant certifies that;

(a) No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a member of Congress, and officer or employee of Congress, or an employee of a Member of Congress in connection with the making of any Federal grant, the entering into continuation, renewal, amendment, or modification of any Federal grant or cooperative agreement,

(b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal Grant or cooperative agreement, the undersigned shall complete and submit Standard Form - LLL, "Disclosure of Lobbying Activities," in accordance with its instructions;

(c) The undersigned shall require that the language of this certification be included in the award document for all sub-awards at all tiers (including sub-grants, contracts under grants and cooperative agreements, and subcontracts) and that all sub-recipients shall certify and disclose accordingly.

1. DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS

As required by Executive Order 12549, Debarment and Suspension and implemented at 21 CFR Part 1404, for prospective participants in primary covered transactions

A. The applicant certifies that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, sentenced to a denial of Federal benefits by a State or Federal court, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three-year period preceding this application been convicted of or and a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain or performing a public (Federal, State, or local) transaction or contract under a public transaction violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) terminated for cause or default; and

B. Where the applicant is unable to certify to any of the statements in this certification, he or she shall attach an explanation to the application.

2. DRUG-FREE WORKPLACE

As required by the Drug Free Workplace Act of 1988, and implemented at 21 CFR Part 1404 Subpart F.

A. The applicant certifies that it will or will continue to provide a drug free workplace by:

(a). Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the applicant's workplace and specifying the actions that will be taken against employees for violations of such prohibition;

(b) Establishing an on-going drug free awareness program to inform employees about:

(1) The dangers of drug abuse in the workplace;

(2) The applicant's policy of maintaining a drug free workplace;

(3) Any available drug counseling, rehabilitation, and employee assistance programs; and

(4) The penalties that may be imposed upon employees for drug abuse violation occurring in the workplace;

(c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a)

(d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee must

- (1) Abide by the terms of the statement; and
- (2) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction.

(e) Notifying the agency, in writing, within 10 calendar days after receiving notice under subparagraph (d)(2) from an employee or otherwise receiving actual notice of such convictions. Employers of convicted employees must provide notice including position title, to: The County of El Paso, Texas, 500 East San Antonio Street, Suite 406, El Paso, Texas 79901. Notice shall include the identification number of each affected grant

(f) Taking one of the following actions within 30 calendar days of receiving notice under subparagraph (d)(2), with respect to any employee who is so convicted:

- (1) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or
- (2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal State, or local health, law enforcement, or other appropriate agency

(g) Making a good faith effort to continue to maintain a drug free workplace through implementation of paragraphs (a), (b), (c), (d), (e), and (f).

3. CERTIFICATION REGARDING FEDERAL DEBT STATUS (OMB Circular A-129)

The Applicant certifies to the best of its knowledge and belief, that it is not delinquent in the repayment of any federal debt.

4. CERTIFICATION REGARDING THE NONDISCRIMINATION STATUTES AND IMPLEMENTING REGULATIONS

The applicant certifies that it will comply with the following nondiscrimination statutes and their implementing regulations: (a) title VI of the Civil right Act of 1964 (42 U.S.C. 2000D et seq.) which provides that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of or be otherwise subjected to discrimination under any program or activity for which the applicant received federal financial assistance; (b) Section 504 of the rehabilitation Act of 1973, as amended (29 U.S.C. 794), which prohibits discrimination on the basis of handicap in programs and activities receiving federal financial assistance; (c) title IX of the Education Amendments of 1972m as amended (20 U.S.C. 1981 et seq.) which prohibits discrimination on the basis of sex in education programs and activities receiving federal financial assistance; and (d) the Age Discrimination Act of 1975, and amended (42 U.S.C. 6101 ec seq.) which prohibits discrimination on the basis of age in programs and activities receiving federal financial assistance, except that actions which reasonably take age into account as a factor necessary

for the normal operation or achievement of any statutory objective of the project or activity shall not violate this statute.

As the duly authorized representative of the applicant, I hereby certify that the applicant will comply with the above certifications.

Business Name

Date

Name of Authorized Representative

Signature of Authorized Representative

COUNTY OF EL PASO PURCHASING DEPARTMENT

COUNTY COURTHOUSE, 500 EAST SAN ANTONIO,
ROOM PU500, EL PASO, TEXAS 79901
(915) 546-2048, FAX: (915) 546-8180

PITI VASQUEZ, PURCHASING AGENT
JOSE LOPEZ, JR. ASST. PURCHASING AGENT
LINDA GONZALEZ, INVENTORY BID TECHNICIAN

BIDDING CONDITIONS

This is the only approved instruction for use on your invitation to bid. Items below apply to and become a part of the terms and conditions of the bid.

1. BY SUBMITTING A BID, EACH BIDDER AGREES TO WAIVE ANY AND ALL CLAIMS IT HAS OR MAY HAVE AGAINST THE COUNTY OF EL PASO, AND ITS OFFICERS, AGENTS AND EMPLOYEES, ARISING OUT OF OR IN CONNECTION WITH: THE DOCUMENTS, PROCEDURES, ADMINISTRATION, EVALUATION, OR RECOMMENDATION OF ANY BID; THE WAIVER BY EL PASO COUNTY OF ANY REQUIREMENTS UNDER THE BID DOCUMENTS OR THE CONTRACT DOCUMENTS; THE ACCEPTANCE OR REJECTION OF ANY BIDS; AND THE AWARD OF THE CONTRACT.
2. Bids must be in the Purchasing Department BEFORE the hour and date specified. Faxed bids will not be accepted.
3. Late bids properly identified will be returned to bidder unopened. Late bids will not be considered under any circumstances.
4. All bids are for new equipment or merchandise unless otherwise specified.
5. Quotes F.O.B. destination. If otherwise, show exact cost to deliver.
6. Bid unit price on quantity specified-extend and show total. In case of error in extension, unit prices shall govern. Bids subject to unlimited price increases will not be considered.
7. Bids must give full firm name and address of bidder. Failure to manually sign bid will disqualify it. Person signing should show title or authority to bind his firm in a contract.
8. No substitutions or cancellations permitted without written approval of County Purchasing Agent.
9. The County reserves the right to accept or reject all or any part of any bid, waive minor technicalities and award the bid to the lowest responsible bidder. The County of El Paso reserves the right to award by item or by total bid. Prices should be itemized.
10. Bids \$100,000.00 and over, the bidder shall furnish a certified cashiers check made payable to the County of El Paso or a good and sufficient bid bond in the amount of 5% of the total contract prices and execute with a surety company authorized to do business in the State of Texas. The bid bond must be included with the bid at the time of the opening.
11. This is a quotation inquiry only and implies no obligation of the part of the County of El Paso.
12. The County of El Paso reserves the right to reject any proposal due to failure of performance on deliveries. The County Purchasing Agent will justify this.
13. Brand names are for descriptive purposes only, not restrictive.
14. The County of El Paso is an Equal Opportunity Employer.

15. Any proposal sent via express mail or overnight delivery service must have the proposal number and title clearly marked on the outside of the express mail or overnight delivery service envelope or package. Failure to clearly identify your proposal may be cause for disqualification.
16. PURSUANT TO TEXAS GOVERNMENT CODE SECTION 2253.021, A PRIME CONTRACTOR WHO IS AWARDED A PUBLIC WORKS CONSTRUCTION CONTRACT SHALL, PRIOR TO BEGINNING THE WORK, EXECUTE TO THE COUNTY:
 - a. A PERFORMANCE BOND, IN THE FULL AMOUNT OF THE CONTRACT, IF THE CONTRACT IS IN EXCESS OF \$100,000; AND
 - b. A PAYMENT BOND, IN THE FULL AMOUNT OF THE CONTRACT, IF THE CONTRACT IS IN EXCESS OF \$25,000.
17. PURSUANT TO TEXAS LOCAL GOVERNMENT CODE SECTION 262.032(b), ANY SUCCESSFUL BIDDER WHO IS AWARDED ANY CONTRACT IN EXCESS OF \$50,000 MAY BE REQUIRED TO EXECUTE A PERFORMANCE BOND TO THE COUNTY. SAID BOND SHALL BE IN THE FULL AMOUNT OF THE CONTRACT AND MUST BE FURNISHED WITHIN 30 DAYS AFTER THE DATE A PURCHASE ORDER IS ISSUED OR THE CONTRACT IS SIGNED AND PRIOR TO COMMENCEMENT OF THE ACTUAL WORK. ANY PERFORMANCE BOND REQUIRED PURSUANT TO THIS SECTION SHALL BE NOTED IN THE ATTACHED DETAILED BID SPECIFICATIONS OR SCOPE OF WORK. THIS SECTION DOES NOT APPLY TO A PERFORMANCE BOND REQUIRED BY CHAPTER 2253, TEXAS GOVERNMENT CODE.
18. "Beginning January 1, 2006, in order to implement HB 914 (adding new Local Government Code Chapter 176), ALL VENDORS MUST SUBMIT A CONFLICT OF INTEREST QUESTIONNAIRE (Form CIQ) disclosing its affiliations and business relationships with the County's Officers (County Judge and Commissioners Court) as well as the County employees and contractors who make recommendations for the expenditure of County funds. The names of the County Officers and of the County employees and contractors making recommendations to the County Officers on this contract are listed in the Specifications.

THE CONFLICT OF INTEREST QUESTIONNAIRE MUST BE FILED WITH THE COUNTY CLERK AND A COPY OR PROOF OF FILING MUST BE ATTACHED TO THE BIDDER'S RESPONSE SUBMITTED TO THE PURCHASING DEPARTMENT.

Bidders should be aware that this bidding condition is not intended to cover or to advise you about all situations in which Local Government Code Chapter 176 would require you to file a Form CIQ. You should consult your private attorney with regard to the application of this law and your compliance requirements. Failure to comply is punishable as a Class C misdemeanor.

NOTICE:

ALL COMMUNICATIONS BY A VENDOR TO THE COUNTY, ITS OFFICIALS, AND DEPARTMENT HEADS REGARDING THIS PROCUREMENT SHALL BE DONE THROUGH THE EL PASO COUNTY PURCHASING DEPARTMENT. **THE EL PASO COUNTY CODE OF ETHICS PROHIBITS ALL PRIVATE COMMUNICATION BETWEEN VENDORS AND CERTAIN COUNTY OFFICIALS AND EMPLOYEES AS DESCRIBED BELOW:**

No vendor, its representative, agent, or employee shall engage in private communication with a member of the El Paso County Commissioners Court or county department heads regarding any procurement of goods or services by the County from the date that the bid, RFP, or RFQ is released. No private communication regarding the purchase shall be permitted until the procurement process is complete and a purchase order is granted or a contract is entered into. Members of the commissioners court are required to make a reasonable effort to inform themselves regarding potential procurements and have a duty to inquire of vendors, their representatives or employees, the nature of any private communication being sought prior to engaging in any communication. "Private Communication" means communication with any vendor outside of a posted meeting of the governing body, a regular meeting of a standing or appointed committee, or a negotiation with a vendor which has been specifically authorized by the governing body.

Health Insurance Benefits Provided By Bidder

Consideration of Health Insurance Benefits*

1. Do you or your subcontractor(s) currently offer health insurance benefits to your employees?

If so, please describe those health insurance benefits that you or your subcontractor(s) currently provide/offer to your employees.

2. What percentage, if any, of your of your subcontractor's employees are currently enrolled in the health insurance benefits program?

El Paso County may consider provision of health insurance benefits as part of the overall "best value" determination. Failure to provide health insurance benefits will not disqualify you from participating in this bid selection process.

Business Name

Date

Name of Authorized Representative

Signature of Authorized Representative

*

* This page must be included in all responses.



COUNTY OF EL PASO
County Purchasing Department
500 East San Antonio, Suite PU500
El Paso, Texas 79901
(915) 546-2048
(915) 546-8180 Fax

RE: Bid #07-089, Construction of Abandoned Motor Vehicle Building for Sheriff's Office

Dear Vendor:

As of January 1, 2006, the Texas Local Government Code Chapter 176 requires all vendors and potential vendors who contract or seek to contract for the sale or purchase of property, goods, or services with any local government entity to complete and submit a Conflicts of Interest Questionnaire. A copy of the requirements regarding vendors is attached. Also attached is a copy of the Questionnaire which needs to be filed and was prepared and approved for statewide use by the Texas Ethics Commission.

In filing out the Questionnaire, the following are the County Officers that will award the bid and the employees which will make a recommendation to the Commissioners Court:

County Officers: County Judge Anthony Cobos
Commissioner Luis C. Sariñana
Commissioner Veronica Escobar
Commissioner Miguel Teran
Commissioner Dan Haggerty

County Employees: Piti Vasquez, Purchasing Agent
Jose Lopez, Jr., Assistant Purchasing Agent
Linda Gonzalez, Inventory Bid Technician
Angel Colorado, Commander

Please note that the state law requires that the Questionnaire be filed with the **COUNTY CLERK** no later than **the 7th business day after submitting an application, response to an RFP, RFQ or bid** or any other writing related to a potential agreement with the County. Failure to file the questionnaire within the time provided by the statute is a Class C misdemeanor

Tex. Local Gov't Code § 176.006 (2005)

§ 176.006. Disclosure Requirements for Vendors and Other Persons; Questionnaire

(a) A person described by Section 176.002(a) shall file a completed conflict of interest questionnaire with the appropriate records administrator not later than the seventh business day after the date that the person:

(1) begins contract discussions or negotiations with the local governmental entity; or

(2) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential agreement with the local governmental entity.

(b) The commission shall adopt a conflict of interest questionnaire for use under this section that requires disclosure of a person's affiliations or business relationships that might cause a conflict of interest with a local governmental entity.

(c) The questionnaire adopted under Subsection (b) must require, for the local governmental entity with respect to which the questionnaire is filed, that the person filing the questionnaire:

(1) describe each affiliation or business relationship the person has with each local government officer of the local governmental entity;

(2) identify each affiliation or business relationship described by Subdivision (1) with respect to which the local government officer receives, or is likely to receive, taxable income from the person filing the questionnaire;

(3) identify each affiliation or business relationship described by Subdivision (1) with respect to which the person filing the questionnaire receives, or is likely to receive, taxable income that:

(A) is received from, or at the direction of, a local government officer of the local governmental entity; and

(B) is not received from the local governmental entity;

(4) describe each affiliation or business relationship with a corporation or other business entity with respect to which a local government officer of the local governmental entity:

(A) serves as an officer or director; or

(B) holds an ownership interest of 10 percent or more;

(5) describe each affiliation or business relationship with an employee or contractor of the local governmental entity who makes recommendations to a local government officer of the local governmental entity with respect to the expenditure of money;

(6) describe each affiliation or business relationship with a person who:

(A) is a local government officer; and

(B) appoints or employs a local government officer of the local governmental entity that is the subject of the questionnaire; and

(7) describe any other affiliation or business relationship that might cause a conflict of interest.

(d) A person described by Subsection (a) shall file an updated completed questionnaire with the appropriate records administrator not later than:

- (1) September 1 of each year in which an activity described by Subsection (a) is pending; and
- (2) the seventh business day after the date of an event that would make a statement in the questionnaire incomplete or inaccurate.
- (e) A person is not required to file an updated completed questionnaire under Subsection (d)(1) in a year if the person has filed a questionnaire under Subsection (c) or (d)(2) on or after June 1, but before September 1, of that year.
- (f) A person commits an offense if the person violates this section. An offense under this subsection is a Class C misdemeanor.
- (g) It is a defense to prosecution under Subsection (f) that the person filed the required questionnaire not later than the seventh business day after the date the person received notice of the violation.

Tex. Local Gov't Code § 176.001 (2005)

§ 176.001. Definitions

In this chapter:

- (1) "Commission" means the Texas Ethics Commission.
- (2) "Family member" means a person related to another person within the first degree by consanguinity or affinity, as described by Subchapter B, Chapter 573, Government Code.
- (3) "Local governmental entity" means a county, municipality, school district, junior college district, or other political subdivision of this state or a local government corporation, board, commission, district, or authority to which a member is appointed by the commissioners court of a county, the mayor of a municipality, or the governing body of a municipality. The term does not include an association, corporation, or organization of governmental entities organized to provide to its members education, assistance, products, or services or to represent its members before the legislative, administrative, or judicial branches of the state or federal government.
- (4) "Local government officer" means:
 - (A) a member of the governing body of a local governmental entity; or
 - (B) a director, superintendent, administrator, president, or other person designated as the executive officer of the local governmental entity.
- (5) "Records administrator" means the director, county clerk, municipal secretary, superintendent, or other person responsible for maintaining the records of the local governmental entity.

CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor or other person doing business with local governmental entity

OFFICE USE ONLY

Date Received

This questionnaire is being filed in accordance with chapter 176 of the Local Government Code by a person doing business with the governmental entity.

By law this questionnaire must be filed with the records administrator of the local government not later than the 7th business day after the date the person becomes aware of facts that require the statement to be filed. See Section 176.006, Local Government Code.

A person commits an offense if the person violates Section 176.006, Local Government Code. An offense under this section is a Class C misdemeanor.

1 Name of person doing business with local governmental entity.

2

☐

Check this box if you are filing an update to a previously filed questionnaire.

(The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than September 1 of the year for which an activity described in Section 176.006(a), Local Government Code, is pending and not later than the 7th business day after the date the originally filed questionnaire becomes incomplete or inaccurate.)

3

Name each employee or contractor of the local governmental entity who makes recommendations to a local government officer of the governmental entity with respect to expenditures of money AND describe the affiliation or business relationship.

4

Name each local government officer who appoints or employs local government officers of the governmental entity for which this questionnaire is filed AND describe the affiliation or business relationship.

CONFLICT OF INTEREST QUESTIONNAIRE

For vendor or other person doing business with local governmental entity

FORM CIQ

Page 2

5

Name of local government officer with whom filer has affiliation or business relationship. (Complete this section only if the answer to A, B, or C is YES.

This section, item 5 including subparts A, B, C & D, must be completed for each officer with whom the filer has affiliation or other relationship. Attach additional pages to this Form CIQ as necessary.

A. Is the local government officer named in this section receiving or likely to receive taxable income from the filer of the questionnaire?

☐

Yes

☐

No

B. Is the filer of the questionnaire receiving or likely to receive taxable income from or at the direction of the local government officer named in this section AND the taxable income is not from the local governmental entity?

☐

Yes

☐

No

C. Is the filer of this questionnaire affiliated with a corporation or other business entity that the local government officer serves as an officer or director, or holds an ownership of 10 percent or more?

☐

Yes

☐

No

D. Describe each affiliation or business relationship.

6

Signature of person doing business with the governmental entity

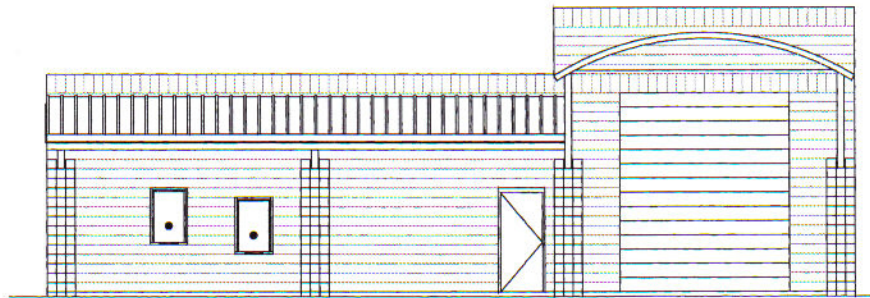
Date



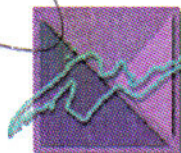
Specifications Manual

El Paso County Sheriff's Office Abandoned Motor Vehicle Building

12501 Montana
El Paso, Texas 79936



4/10/07



McCormick
Architecture

4110 Rio Bravo, Suite 206
El Paso, Texas 79902
(915) 533-2288

McCormick Architecture, LLC
4110 Rio Bravo Ste. 206
El Paso, Texas 79902
915 533-2288
915 533-2280 (fax)

El Paso County Sheriff's Office
Abandoned Motor Vehicle Building
McCormick Architecture Project No. 60102
April 10, 2007

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SECTION 01100 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents.
 - 2. Work phases.
 - 3. Work under other contracts.
 - 4. Use of premises.
 - 5. Owner's occupancy requirements.
 - 6. Specification formats and conventions.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: El Paso County Sheriff's Office Abandoned Motor Vehicle Building
 - 1. Project Location: 12501 Montana, El Paso, Texas 79936.
- B. Owner: County of El Paso Texas, 500 E. San Antonio, El Paso, Texas 79901.
 - 1. Owner's Representative: Captain Angel Colorado, 601 E. Overland, El Paso, Texas 79901.
- C. Architect Identification: The Contract Documents, dated April 10, 2007, were prepared for Project by McCormick Architecture LLC, 4110 Rio Bravo, Suite 206, El Paso, Texas 79902.
- D. The Work consists of the following:
 - 1. The Work includes an approximate 1,700 square foot masonry building with a metal roof. A covered porch area at front of building will also be part of this contract. An approximate 1,100 square feet of this building will be used as office space, fully built out, and the remaining 600 square feet will be used as garage with independent heating and cooling. This building is designed to meet handicap accessibility requirements, Americans with Disabilities Act (A.D.A.) and Texas Accessibility Standards (T.A.S.) as well as local International Building Code 2003 (IBC 2003).
- E. Project will be constructed under a single prime contract.

1.3 WORK UNDER OTHER CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.4 USE OF PREMISES

- A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- C. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Limits: Confine constructions operations to minimal site disturbance.
 - 2. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.
 - 3. Driveways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.5 OWNER'S OCCUPANCY REQUIREMENTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits, unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
- B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
 - 3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.6 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.
 - 1. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01100

SECTION 01140 - WORK RESTRICTIONS

PART 1 - GENERAL

1.1 USE OF PREMISES

- A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.
 - 1. Limits: Confine constructions operations between east side of existing impound facility yard and west side of existing fenced concrete lot as shown on construction document set.
 - 2. Owner Occupancy: Allow for Owner occupancy of site.
 - 3. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

1.2 OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: Owner will occupy site and existing building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01140

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 time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
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 14 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 14 days after such authorization.
1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

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.
 - 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

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.
- B. See Division 1 Section "Summary of Multiple Contracts" for a description of the division of Work among separate contracts and responsibility for coordination activities not in this Section.
- C. See Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

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

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Indicate relationship of components shown on separate Shop Drawings.
 2. Indicate required installation sequences.
 3. See Division 15 Section "Basic Mechanical Materials and Methods" for specific Coordination Drawing requirements for mechanical installations.
 4. See Division 16 Section "Basic Electrical Materials and Methods" for specific Coordination Drawing requirements for electrical installations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's Construction Schedule.
 - 2. Submittals Schedule.
 - 3. Daily construction reports.
 - 4. Field condition reports.
 - 5. Construction photographs.
- B. See Division 1 Section "Summary of Multiple Contracts" for preparing a combined Contractor's Construction Schedule.
- C. See Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
- D. See Division 1 Section "Closeout Procedures" for submitting photographic negatives as Project Record Documents at Project closeout.

1.2 DEFINITIONS

- A. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- B. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time belongs to Owner
- C. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- D. Major Area: A story of construction, a separate building, or a similar significant construction element.

1.3 SUBMITTALS

- A. Submittals Schedule: Submit three (3) copies of schedule. Arrange the following information in a tabular format:
 - 1. Scheduled date for first submittal.
 - 2. Specification Section number and title.
 - 3. Submittal category (action or informational).
 - 4. Name of subcontractor.
 - 5. Description of the Work covered.
 - 6. Scheduled date for Architect's final release or approval.

- B. Preliminary Network Diagram: Submit two (2) printed copies, one a single sheet of reproducible media and one a print, large enough to show entire network for entire construction period.
- C. Contractor's Construction Schedule: Submit two (2) printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.
- D. CPM Reports: Concurrent with CPM schedule, submit three (3) printed copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
- E. Daily Construction Reports: Submit two 2 copies at weekly intervals.
- F. Field Condition Reports: Submit two (2) copies at time of discovery of differing conditions.

END OF SECTION 01320

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 "Quality Requirements" for submitting test and inspection reports and Delegated-Design Submittals.
- D. 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. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals.

- Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Allow 15 days for processing each resubmittal.
 4. 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.
 2. Provide a space approximately 4 by 5 inches 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 Architect.
 - d. Name and address of Contractor.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Unique identifier, including revision number.
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. 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 may serve as final submittal.
1. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
- 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.
 2. Transmittal Form: Use AIA Document G810.
- 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 five (5) copies of each submittal, unless otherwise indicated. Architect will return three (3) copies. 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:
 - 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. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."
- E. 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 three (3) full set[s] 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 three (3) sets of Samples. Architect will retain two (2) Sample sets; remainder will be returned.
 - 4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side.
 - 5. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
 - 6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
- F. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location.
- G. Delegated-Design Submittal: Comply with requirements in Division 1 Section "Quality Requirements."
- H. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."
- I. Application for Payment: Comply with requirements in Division 1 Section "Payment Procedures."
- J. Schedule of Values: Comply with requirements in Division 1 Section "Payment Procedures."

- K. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 - 1. Number of Copies: Submit three (3) copies of each submittal, 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. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
- H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- I. 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.
- J. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed

before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

- K. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.
- L. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- M. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- N. 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."
- O. 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.
- P. 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.
- Q. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections.
- R. 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.
- S. Construction Photographs: Comply with requirements in Division 1 Section "Construction Progress Documentation."

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

- A. **General:** Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. **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, as follows:
 - 1. Approved insert description of each action indicated on Architect's stamp.
 - 2. Approved as noted.
 - 3. Revise and resubmit.
 - 4. Submit additional information.
- A. **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.
- B. **Submittals not required by the Contract Documents** will not be reviewed and may be discarded.

END OF SECTION 01330

SECTION 01400 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

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

1.3 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.

- 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 reinspecting.
- 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.

END OF SECTION 01400

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.
- B. See Division 1 Section "Execution Requirements" for progress cleaning requirements.

1.2 DEFINITIONS

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

1.3 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces occupants of Project Architect testing and inspecting agencies and personnel of authorities having jurisdiction.
- B. Water Service: Use water from Owner's existing water system without metering and without payment of use charges.
- C. Electric Power Service: Use electric power from Owner's existing system without metering and without payment of use charges.

1.4 SUBMITTALS

- A. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

1. END OF SECTION 01500

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. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. 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. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 2. Completed List: Within 30 days after date of commencement of the Work, submit 5 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 3. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.
- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use CSI Form 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.

1. 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 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
 - a. Form of Acceptance: Change Order.
 - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- C. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

END OF SECTION 01600

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. Correction of the Work.

1.2 SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- B. Certified Surveys: Submit two copies signed by land surveyor.

1.3 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.

END OF SECTION 01700

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.
 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 (3) 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. Use CSI Form 14.1A.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

1.5 PROJECT RECORD DOCUMENTS

- 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.
- 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 seven (7) days' advance notice.
 4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.
- B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline.
1. Include instruction for system design and operational philosophy, review of documentation, operations, adjustments, troubleshooting, maintenance, and repair.

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.
 - 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

SECTION 01781 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. See Division 1 Section Closeout Procedures and Operation and Maintenance Data for operation and maintenance manual requirements.
- C. See Divisions 2 through 16 Sections for specific requirements for Project Record Documents of products in those Sections.

1.2 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit 3 sets of marked-up Record Prints.
 - 2. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal: Submit one set (1) of corrected Record Transparencies and one set (1) of marked-up Record Prints. Architect will initial and date each transparency and mark whether general scope of changes, additional information recorded, and quality of drafting are acceptable. Architect will return transparencies and prints for organizing into sets, printing, binding, and final submittal.
 - b. Final Submittal: Submit one set (1) of marked-up Record Prints, and the following:
 - 1) Record Transparencies: One set
 - 2) Copies printed from Record Transparencies: Three (3). Print each Drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one copy (1) of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one copy (1) of each Product Data submittal.

END OF SECTION 01781

SECTION 01782 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Emergency manuals.
 - 2. Operation manuals for systems, subsystems, and equipment.
 - 3. Maintenance manuals for the care and maintenance of products, materials, finishes, systems and equipment.
- B. See Divisions 2 through 16 Sections for specific operation and maintenance manual requirements for products in those Sections.

1.2 SUBMITTALS

- A. Manual: Submit 1 copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
 - 1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

END OF SECTION 01782

SECTION 02751 - CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes cement concrete pavement for the following applications:
 - 1. Walkways.

1.2 SUBMITTALS

- A. Product Data: For each manufactured material and product indicated.
- B. Design Mixes: For each concrete mix indicated.
- C. Material certificates.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcement Bars: ASTM A 615/A 615M, grade 60, deformed.
- C. Plain Steel Wire: ASTM A 82, as drawn.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening steel reinforcement. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

2.2 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II.

END OF SECTION 02751

SECTION 02764 - PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes cold and hot applied pavement joint sealants in the following locations.
 - 1. Portland cement concrete pavement expansion and contraction joints.
 - 2. Joints between portland cement concrete and asphalt pavement.

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Samples: For each type and color of joint sealant indicated.
- C. Product certificates and test reports.
- D. Sealant compatibility and adhesion test reports.

1.3 QUALITY ASSURANCE

- A. Sealant Compatibility and Adhesion Testing: Use sealant manufacturer's standard test.

END OF SECTION 02764

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Formwork: Furnish formwork and form accessories according to ACI 301.
- B. Steel Reinforcement:
 - 1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

2. Plain-Steel Wire: ASTM A 82, as drawn.
3. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
4. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.

C. Concrete Materials:

1. Portland Cement: ASTM C 150, Type I or II or I/II.
2. Normal-Weight Aggregate: ASTM C 33, uniformly graded, not exceeding 1-1/2-inch (38-mm) nominal size.
3. Lightweight Aggregate: ASTM C 330.
4. Water: Complying with ASTM C 94.
5. Synthetic Fiber: Fibrillated or monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

D. Admixtures:

1. Air-Entraining Admixture: ASTM C 260.
2. Water-Reducing Admixture: ASTM C 494, Type A.
3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

E. Vapor Retarder: Multi-ply reinforced polyethylene sheet, ASTM E 1745, Class C, not less than 7.8 mils (0.18 mm) thick; or polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

1. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 (4.75-mm) sieve and 10 to 30 percent passing a No. 100 (0.15-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

F. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

G. Curing Materials:

1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf.
3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
4. Water: Potable.
5. Clear, Solvent-Borne or Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
6. Clear, Solvent-Borne or Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.2 CONCRETE MIXES

- A. Comply with ACI 301 requirements for concrete mixtures.

- B. Prepare design mixes, proportioned according to ACI 301, for normal-weight concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Compressive Strength (28 Days): 3000 psi (20.7 MPa).
 - 2. Slump: 4 inches (100 mm).
 - a. Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches (200 mm) after adding admixture to plant- or site-verified, 2- to 3-inch (50- to 75-mm) slump.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of minimum 5.0 percent.
 - 1. Air content of trowel-finished interior concrete floors shall not exceed 3.0 percent.
- D. Lightweight Structural Concrete Mix: ASTM C 330, proportioned to produce concrete with a minimum compressive strength of 3000 psi (20.7 MPa) at 28 days and a calculated equilibrium unit weight of 110 lb/cu. ft. (1762 kg/cu. m) plus or minus 3 lb/cu. ft. (48 kg/cu. m), as determined by ASTM C 567. Concrete slump at point of placement shall be the minimum necessary for efficient mixing, placing, and finishing.
 - 1. Limit slump to 5 inches (125 mm) for troweled slabs and 4 inches (100 mm) for other slabs.
- E. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than [1.0 lb/cu. yd. (0.60 kg/cu. m)] [1.5 lb/cu. yd. (0.90 kg/cu. m)].

2.3 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with ASTM C 94 and ASTM C 1116.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 - 2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
- C. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Formwork: Design, construct, erect, shore, brace, and maintain formwork according to ACI 301.
- B. Vapor Retarder: Install, protect, and repair vapor-retarder sheets according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
 - 2. Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).
- C. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- D. Joints: Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 1. Construction Joints: Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Architect.
 - 2. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - a. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - 3. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
 - a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
 - b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- E. Tolerances: Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3.2 CONCRETE PLACEMENT

- A. Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

- B. Do not add water to concrete during delivery, at Project site, or during placement.
- C. Consolidate concrete with mechanical vibrating equipment.

3.3 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch (6 mm) in height rubbed down or chipped off.
 - 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 defective areas. Completely remove fins and other projections.
 - 1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 - 2. Do not apply rubbed finish to smooth-formed finish.
 - 3. Apply [smooth-rubbed] [grout-cleaned] [cork-floated] finish, defined in ACI 301, to smooth-formed finished concrete.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.4 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.
 - 1. Do not further disturb surfaces before starting finishing operations.
- C. Scratch Finish: Apply scratch finish to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finish, unless otherwise indicated.
- D. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- E. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

- F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- G. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.5 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection, and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions occur before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Cure formed and unformed concrete for at least seven days as follows:
 - 1. Moisture Curing: Keep surfaces continuously moist with [water] [continuous water-fog spray] [absorptive cover, water saturated and kept continuously wet].
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Tests will be performed according to ACI 301.
 - 1. Testing Frequency: One composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - 2. Testing Frequency: At least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.

END OF SECTION 03300

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
 - 1. Concrete masonry units (CMUs).
 - 2. Decorative concrete masonry units.
 - 3. Pre-faced concrete masonry units.
- B. See Division 5 Section "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
- C. See Division 7 Section "Sheet Metal Flashing and Trim" for furnishing manufactured reglets installed in masonry joints for metal flashing.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For reinforcing steel. Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
- C. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.
 - 1. For masonry units include material test reports substantiating compliance with requirements.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1.3 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.
 3. 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.
 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 COLORS, TEXTURES, AND PATTERNS

- A. Exposed Masonry Units: Standard Color.

2.3 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- B. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength for exposed units and where indicated.
1. Available Products:
 - a. Addiment Incorporated; Block Plus W-10.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block.
 - c. Master Builders, Inc.; Rheopel.
- C. Concrete Masonry Units: ASTM C-90.
1. Weight Classification: Normal weight.
 2. Pattern and Texture for Decorative Units:
 - a. Standard pattern, ground finish.
 3. Pre-faced Concrete Masonry Units: Lightweight concrete units, with smooth resinous facing complying with ASTM C 744.
 - a. Size: Manufactured with pre-faced surfaces having 1/16-inch- (1.5-mm-) wide returns of facing to create 1/4-inch- (6.5-mm-) wide mortar joints.

2.4 CONCRETE AND MASONRY LINTELS

- A. Masonry Lintels: Made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout.

2.5 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction.

- B. Hydrated Lime: ASTM C 207, Type S.

- C. Masonry Cement: ASTM C 91.

- 1. Available Products:

- a. Capital Materials Corporation; Flamingo Color Masonry Cement.
- b. Essroc, Italcementi Group; [Brixment] [or] [Velvet].
- c. Holcim (US) Inc.; [Mortamix Masonry Cement] [Rainbow Mortamix Custom Buff Masonry Cement] [White Mortamix Masonry Cement].
- d. Lafarge North America Inc.; [Magnolia Masonry Cement] [Lafarge Masonry Cement] [Florida Super Masonry] [Trinity Super White Masonry Type S] [Trinity White Masonry Type N].
- e. Lehigh Cement Company; [Lehigh Masonry Cement] [Lehigh White Masonry Cement].
- f. National Cement Company, Inc.; Coosa Masonry Cement.

- 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.

- 1. Available Products:

- a. Bayer Corporation, Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
- b. Davis Colors; True Tone Mortar Colors.
- c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.

- E. Colored Cement Product: Packaged blend made from [portland cement and lime] [or] [masonry cement] and mortar pigments, all complying with specified requirements, and containing no other ingredients.

- 1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.

- 2. [Available]Products:

- a. Colored Portland Cement-Lime Mix:

- 1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
- 2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
- 3) Lafarge North America Inc.; Eaglebond.

- 4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
 - 5) <Insert manufacturer's name; product name or designation.>
 - b. Colored Masonry Cement:
 - 1) Capital Materials Corporation; Flamingo Color Masonry Cement.
 - 2) Essroc, Italcementi Group; Brixment-in-Color.
 - 3) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
 - 4) Lafarge North America Inc.; [Florida Custom Color Masonry] [or] [Magnolia Masonry Cement].
 - 5) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
 - 6) National Cement Company, Inc.; Coosa Masonry Cement.
 - 7) <Insert manufacturer's name; product name or designation.>
- F. 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.
- G. Aggregate for Grout: ASTM C 404.
- H. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units.
- I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 1. Available Products:
 - a. Addiment Incorporated; Mortar Kick.
 - b. Euclid Chemical Company (The); Accelguard 80.
 - c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
 - d. Sonneborn, Div. of ChemRex; Trimix-NCA.
- J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
 1. Available Products:
 - a. Addiment Incorporated; Mortar Tite.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
 - c. Master Builders, Inc.; [Color Cure Mortar Admix] [or] [Rheomix Rheopel].
- K. Water: Potable.

2.6 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: ASTM A 951; mill galvanized, carbon-steel wire for interior walls and hot-dip galvanized, carbon-steel wire for exterior walls.
 - 1. Wire Size for Side Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
 - 2. Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.
 - 3. Wire Size for Veneer Ties: W1.7 or 0.148-inch (3.8-mm) diameter.
 - 4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
 - 5. Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
 - 6. Multiwythe Masonry:
 - a. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches (100 mm) in width, plus 1 side rod at each wythe of masonry 4 inches (100 mm) or less in width.
 - b. Tab type, with 1 side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.
 - c. Adjustable (two-piece) type, with one side rod at each face shell of backing wythe and with ties that extend into facing wythe. Ties engage eyes or slots in reinforcement and extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.[Ties have hooks or clips to engage a continuous wire in the facing wythe.]
 - 7. Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized, carbon-steel continuous wire.

2.7 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.
 - 2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
 - 3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- 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. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.
 - 1. Wire: Fabricate from 1/4-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire.

- D. Adjustable Anchors for Connecting to Structure: 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- (6.4-mm-) diameter, hot-dip galvanized steel wire.
 - 2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.25-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire.
 - 3. Connector Section for Concrete: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from .097-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication.
- E. Partition Top anchors: 0.097-inch- (2.5-mm-) thick metal plate with 3/8-inch- (10-mm-) diameter metal rod 6 inches (150 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.4 mm) thick by 24 inches (600 mm) long, with ends turned up 2 inches (50 mm) or with cross pins.
 - 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

2.8 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with Division 7 Section "Sheet Metal Flashing and Trim."
 - 1. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
 - 2. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches (75 mm) into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch (19 mm) and down into joint 3/8 inch (10 mm) to form a stop for retaining sealant backer rod.
- B. Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 Section "Sheet Metal Flashing and Trim."
- C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene, urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall.

- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weep/Vent Products: Use one of the following, unless otherwise indicated:
 - 1. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches (9 by 38 by 89 mm) long.
 - 2. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Available Products:
 - 1) Advanced Building Products Inc.; Mortar Maze weep vent.
 - 2) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
 - 3) Heckmann Building Products Inc.; No. 85 Cell Vent.
 - 4) Hohmann & Barnard, Inc.; Quadro-Vent.
 - 5) Wire-Bond; Cell Vent.

2.10 INSULATION

- A. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).
- B. Molded-Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene-resin beads or granules in a closed mold to comply with ASTM C 578, Type I. Provide specially shaped units designed for installing in cores of masonry units.
 - 1. Available Products:
 - a. Concrete Block Insulating Systems; Korfil.
 - b. Shelter Enterprises Inc.; Omni Core.

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

2.12 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Limit cementitious materials in mortar for exterior and reinforced 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, Proportion Specification.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification.
 - 1. For masonry below grade or in contact with earth, use Type S.
 - 2. For reinforced masonry, use Type S.
 - 3. For mortar parge coats, use Type S.
 - 4. 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.
 - 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Use colored cement product[or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products].
 - 1. Pigments shall not exceed 10 percent of portland cement by weight.
 - 2. Pigments shall not exceed 5 percent of masonry cement by weight.
- E. 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 Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.
- F. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

- C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
- D. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
 - 1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.

3.2 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- E. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.3 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- 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. Lay structural-clay tile as follows:

1. Lay vertical-cell units with full head joints, unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
 2. Lay horizontal-cell units with full bed joints, unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position.
 3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- (6- to 10-mm-) thick joints.
 4. Where epoxy-mortar pointed joints are indicated, rake out setting mortar to a uniform depth of 1/4 inch (6 mm) and point with epoxy mortar.
- D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.4 COMPOSITE MASONRY

- A. Bond wythes of composite masonry together using one of the following methods:
1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for [4.5 sq. ft. (0.42 sq. m)] [2.67 sq. ft. (0.25 sq. m)] of wall area spaced not to exceed [36 inches (914 mm)] [24 inches (610 mm)] o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use [ladder-type reinforcement extending across both wythes] [tab-type reinforcement].
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement[with continuous horizontal wire in facing wythe attached to ties].
- B. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
- C. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.
- D. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
1. Provide individual metal ties not more than 16 inches (406 mm) o.c.
 2. Provide continuity with masonry joint reinforcement by using prefabricated T-shaped units.
 3. Provide rigid metal anchors not more than [24 inches (610 mm)] [48 inches (1220 mm)] o.c. If used with hollow masonry units, embed ends in mortar-filled cores.

3.5 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for [4.5 sq. ft. (0.42 sq. m)] [2.67 sq. ft. (0.25 sq. m)] of wall area spaced not to exceed [36 inches (914 mm)] [24 inches (610 mm)] o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
 2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use [ladder-type reinforcement extending across both wythes] [tab-type reinforcement].
 - b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement[with continuous horizontal wire in facing wythe attached to ties].
 - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement[with continuous horizontal wire in facing wythe attached to ties] to allow for differential movement regardless of whether bed joints align.
 3. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Parge cavity face of backup wythe in a single coat approximately 3/8 inch (10 mm) thick. Trowel face of parge coat smooth.
- D. Coat cavity face of backup wythe to comply with Division 7 Section "Bituminous Dampproofing."
- E. 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.

3.6 MASONRY-CELL INSULATION

- A. Pour granular insulation into cavities to fill void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to 1 story in height, but not more than 20 feet (6 m).
- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Install 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).
- 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.

3.8 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 - 1. Provide an open space not less than 1 inch (25 mm) in width between masonry and structural member, unless otherwise indicated.
 - 2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.
- B. Install flashing as follows, unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing as recommended by flashing manufacturer.
 - 2. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
 - 3. 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.
 - 4. 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.
- C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - 1. Use specified weep/vent products or open head joints to form weep holes.
 - 2. Space weep holes 24 inches (600 mm) o.c., unless otherwise indicated.
 - 3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
- D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

- E. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products or open head joints to form vents.
 - 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.9 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 temporary 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).

3.10 FIELD QUALITY CONTROL

- A. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.
- B. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.
- C. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.
- D. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

3.11 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in 2 uniform coats to a total thickness of 3/4 inch (19 mm) with a steel-trowel finish. Form a wash at top of parging and a cove at bottom. Damp-cure parging for at least 24 hours and protect parging until cured.

3.12 CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 - 2. Protect adjacent surfaces from contact with cleaner.
 - 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 - 6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.13 MASONRY WASTE DISPOSAL

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

END OF SECTION 04810

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes structural steel and grout.

1.2 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.
 - 1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Load and Resistance Factor Design," Volume 2, Part 9 and/or AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
- C. Welding certificates.
- D. Mill test reports.
- E. Source quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- C. Comply with applicable provisions of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Preinstallation Conference: Conduct conference at Project site.

END OF SECTION 05120

SECTION 05400 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior load-bearing wall framing.
2. Interior load-bearing wall framing.
3. Exterior non-load-bearing, curtain-wall framing.
4. Floor joist framing.
5. Roof trusses.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads without deflections greater than the following:

1. Exterior Load-Bearing Wall Framing: Horizontal deflection of $1/240$ of the wall height.
2. Interior Load-Bearing Wall Framing: Horizontal deflection of $1/240$ of the wall height.
3. Exterior Non-Load-Bearing, Curtain-Wall Framing: Horizontal deflection of $1/240$ of the wall height.
4. Roof Trusses: Vertical deflection of $1/240$ of the span.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Mill certificates or test reports.

D. Welder certificates.

E. Research/evaluation reports.

END OF SECTION 05400

SECTION 06105 - MISCELLANEOUS CARPENTRY

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. Wood blocking and nailers.
- B. Related Sections include the following:
 - 1. Division 6 Section "Interior Architectural Woodwork" for interior woodwork not specified in this Section.

1.3 DEFINITIONS

- A. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NELMA - Northeastern Lumber Manufacturers Association.
 - 2. NLGA - National Lumber Grades Authority.
 - 3. SPIB - Southern Pine Inspection Bureau.
 - 4. WCLIB - West Coast Lumber Inspection Bureau.
 - 5. WWPA - Western Wood Products Association.

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
 - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
 - 1. Preservative-treated wood.
 - 2. Fire-retardant-treated wood.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 4. Provide dressed lumber, S4S, unless otherwise indicated.
 - 5. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP C2 (lumber), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWP C31 with inorganic boron (SBX).
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and one of the following:
 - a. Chromated copper arsenate (CCA).
 - b. Ammoniacal copper zinc arsenate (ACZA).
 - c. Ammoniacal, or amine, copper quat (ACQ).
 - d. Copper bis (dimethyldithiocarbamate) (CDDC).
 - e. Ammoniacal copper citrate (CC).
 - f. Copper azole, Type A (CBA-A).
 - g. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
- B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated and all concealed interior applications provide materials that comply with performance requirements in AWWPA C20 (lumber). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber.
2. Use treatment that does not promote corrosion of metal fasteners.
3. Use Interior Type A High Temperature (HT), unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Cants.
3. Nailers.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content and any of the following species:

1. Mixed southern pine; SPIB.
2. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods; NELMA.
5. Northern species; NLGA.
6. Western woods; WCLIB or WWPA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.
2. Eastern softwoods, No. 2 Common grade; NELMA.
3. Northern species, No. 2 Common grade; NLGA.
4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.
5. Grade D Select (Quality) Idaho white, lodgepole, ponderosa, or sugar pine; NLGA or WWPA.
6. Grade A Finish alder, aspen, basswood, cottonwood, gum, magnolia, soft maple, sycamore, tupelo, or yellow poplar; NHLA.

2.5 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
 - 1. Use fire resistive products at all interior locations.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION 06105

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes interior woodwork including for the following applications:
 - 1. Standing and running trim.
 - 2. Wood cabinets.
 - 3. Plastic-laminate cabinets.
 - 4. Plastic-laminate countertops.
 - 5. Solid-surfacing-material countertops.
 - 6. Flush wood paneling and wainscots.
 - 7. Stairwork and rails.
 - 8. Frames and jambs.
 - 9. Shop finishing of woodwork.
- B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips, unless concealed within other construction before woodwork installation.
- C. Rough carriages for stairs are interior architectural woodwork.
 - 1. See Division 6 Section "Rough Carpentry" for platform framing and other rough framing associated with stairwork.

1.2 SUBMITTALS

- A. Product Data: For the following:
 - 1. Cabinet hardware and accessories.
 - 2. Handrail brackets.
 - 3. Finishing materials and processes.
- B. Shop Drawings: Include location of each item, plans and elevations, large-scale details, attachment devices, and other components.
- C. Samples:
 - 1. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge.
 - 2. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with exposed surface finished.
 - 3. Plastic-laminate-clad panel products, for each type, color, pattern, and surface finish.
 - 4. Thermoset decorative-overlay surfaced panel products, for each type, color, pattern, and surface finish.
 - 5. Solid-surfacing materials.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of woodwork.
- B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.
 - 1. Provide AWI certification labels or compliance certificate indicating that woodwork complies with requirements of grades specified.
- C. Quality Standard: Unless otherwise indicated, comply with WIC's "Manual of Millwork" for grades of interior architectural woodwork, construction, finishes, and other requirements.
 - 1. Provide WIC-certified compliance certificate indicating that woodwork complies with requirements of grades specified.
 - 2. Provide WIC-certified compliance certificate for installation.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

END OF SECTION 06402

SECTION 07210 - BUILDING INSULATION

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. Concealed building insulation.
 - 2. Perimeter fire-containment systems.
- B. Related Sections include the following:
 - 1. Division 9 Sections "Gypsum Board Assemblies" and "Gypsum Board Shaft-Wall Assemblies" for installation in metal-framed assemblies of insulation specified by reference to this Section.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.

1.5 DELIVERY, STORAGE, AND HANDLING

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

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:
1. Glass-Fiber Insulation:
 - a. CertainTeed Corporation.
 - b. Johns Manville Corporation.
 - c. Knauf Fiber Glass.
 - d. Owens Corning.
 2. Slag-Wool-/Rock-Wool-Fiber Insulation:
 - a. Fibrex Insulations Inc.
 - b. Owens Corning.
 - c. Thermafiber.
 3. Perimeter Fire-Containment Systems:
 - a. United States Gypsum Co.

2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
- B. Faced Mineral-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame spread of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on one face; consisting of fibers manufactured from glass, slag wool, or rock wool.
1. Use: R-19, at exterior perimeter walls, full height U.N.O.
 2. Use: R-30 at underside of deck throughout U.N.O.
- C. Glass-Fiber Loose-Fill Insulation: ASTM C 764 for type (method of application) indicated below; maximum flame-spread and smoke-developed indices of 5, and as follows:
1. Type 1 for pneumatic application.
 2. Type 2 for poured application.

2.3 PERIMETER FIRE-CONTAINMENT SYSTEMS

- A. Where indicated for gaps between the perimeter edge of fire-resistance-rated floor assemblies and non-fire-resistance-rated exterior curtain walls, provide a perimeter fire-containment system with the fire-test-response characteristics indicated, as determined by testing identical systems per UBC Standard 26-9 and

UL 2079 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

2.4 AUXILIARY INSULATING MATERIALS

- A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.5 INSULATION FASTENERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Adhesively Attached, Spindle-Type Anchors:

- a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
- b. Eckel Industries of Canada Limited; Stic-Klip Type N Fasteners.
- c. Gemco; Spindle Type.

2. Adhesively Attached, Angle-Shaped, Spindle-Type Anchor:

- a. Gemco; 90-Degree Insulation Hangers.

3. Insulation-Retaining Washers:

- a. AGM Industries, Inc.; RC150.
- b. AGM Industries, Inc.; SC150.
- c. Gemco; Dome-Cap.
- d. Gemco; R-150.
- e. Gemco; S-150.

4. Insulation Standoff:

- a. Gemco; Clutch Clip.

5. Anchor Adhesives:

- a. AGM Industries, Inc.; TACTOO Adhesive.
- b. Eckel Industries of Canada Limited; Stic-Klip Type S Adhesive.
- c. Gemco; Tuff Bond Hanger Adhesive.

- B. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
2. Spindle: Copper-coated, low carbon steel, fully annealed, 0.105 inch (2.67 mm) in diameter, length to suit depth of insulation indicated.

- C. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Angle: Formed from 0.030-inch- (0.762-mm-) thick, perforated, galvanized carbon-steel sheet with each leg 2 inches (50 mm) square.
 2. Spindle: Copper-coated, low carbon steel, fully annealed, 0.105 inch (2.67 mm) in diameter, length to suit depth of insulation indicated.
- D. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawlspace.
 - b. Ceiling plenums.
 - c. Attic spaces.
 - d. Where indicated.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

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

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
 - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- C. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
 - 1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.
 - 4. Maintain minimum 1" airspace at spandrel glass.
- D. Stuff glass-fiber, loose-fill insulation into miscellaneous voids and cavity spaces. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

3.5 INSTALLATION OF PERIMETER FIRE-CONTAINMENT SYSTEMS

- A. Install perimeter fire-containment systems to fill gap between edge of concrete floor slab and back of spandrel panels of exterior curtain-wall systems to comply with fire-containment system manufacturer's written instructions to produce installations with ratings matching those established during fire-test-response testing.

3.6 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07210

SECTION 07411 - METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Factory-formed and field-assembled, standing-seam metal roof panels.
 - 2. Metal soffit panels.
- B. See Division 7 Section "Sheet Metal Roofing" for custom-fabricated and on-site, roll-formed sheet metal roofing.

1.2 PERFORMANCE REQUIREMENTS

- A. Wind-Uplift Resistance: Comply with UL 580 for wind-uplift resistance class indicated.
- B. Structural Performance: Capable of withstanding the effects of gravity loads and the following loads and stresses, based on testing according to ASTM E 1592:
 - 1. Wind Loads: Minimum design wind pressures of 16 lbf/sq. ft., acting inward or outward.
 - 2. Snow Loads: 7 lbf/sq. ft. Delete subparagraph below if structural metal roof panels are not required. Verify that loads are indicated on Drawings. Verify deflection limits below with authorities having jurisdiction.
 - 3. Deflection Limits: Vertical deflections no greater than 1/240 of the span.
- C. Seismic Performance: Provide metal roof panel assemblies capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

1.3 SUBMITTALS

- A. Product Data: For each type of metal roof panel and accessory indicated.
- B. Shop Drawings: Show layouts of metal roof panels, including plans, elevations, sections, details, and attachments to other work.
 - 1. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories.
 - 2. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Coordination Drawings: Drawn to scale and coordinating metal roof panel installation with penetrations and roof-mounted items.
- D. Samples: For each exposed finish.
- E. Material certificates.

- F. Field quality-control inspection reports.
- G. Product test reports.
- H. Maintenance data.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - 1. Installer's responsibilities include fabricating and installing metal roof panel assemblies and providing professional engineering services needed to assume engineering responsibility.
- B. Preinstallation Conference: Conduct conference at Project site.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal roof panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Two (2) years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Siliconized Polyester Finish Warranty Period: (10) ten years from date of Substantial Completion.
 - 2. Fluoropolymer Finish Warranty Period: (20) twenty years from date of Substantial Completion.

END OF SECTION 07411

SECTION 07620 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Manufactured reglets.
 - 2. Formed roof drainage system.
 - 3. Formed low-slope roof flashing and trim.
 - 4. Formed steep-slope roof flashing and trim.
 - 5. 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.

END OF SECTION 07620

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.
 - 2. Exterior joints in horizontal traffic surfaces.
 - 3. Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 4. Interior joints in horizontal traffic surfaces.
- B. See Division 2 Section "Pavement Joint Sealants" for sealing joints in pavements, walkways, and curbing.
- C. See Division 8 Section "Glazing" for glazing sealants.

1.2 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- C. Preconstruction field test reports.
- D. Compatibility and adhesion test reports.
- E. Product certificates and test reports.

1.4 QUALITY ASSURANCE

- A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

- B. 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.
- C. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
 - 1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

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: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: (2) two years from date of Substantial Completion.

END OF SECTION 07920

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Steel doors.
 - 2. Steel door frames.
 - 3. Sidelight frames
 - 4. Borrowed-light frames.
 - 5. Fire-rated door and frame assemblies.
 - 6. Fire-rated window frames.
 - 7. Louvers in doors.
- B. Related Sections include the following:
 - 1. Division 4 Section "Unit Masonry Assemblies" for installing anchors and grouting frames in masonry construction.
 - 2. Division 8 Section "Flush Wood Doors" for wood doors installed in steel frames.
 - 3. Division 8 Section "Door Hardware (Scheduled by Naming Products)" for door hardware and weather stripping.
 - 4. Division 8 Section "Glazing" for glass in glazed openings in doors and frames.
 - 5. Division 9 Section "Painting" for field painting factory-primed doors and frames.

1.3 DEFINITIONS

- A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.4 SUBMITTALS

- A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.
- B. Shop Drawings: Show the following:
 - 1. Elevations of each door design.
 - 2. Details of doors including vertical and horizontal edge details.
 - 3. Frame details for each frame type including dimensioned profiles.
 - 4. Details and locations of reinforcement and preparations for hardware.

5. Details of each different wall opening condition.
 6. Details of anchorages, accessories, joints, and connections.
 7. Coordination of glazing frames and stops with glass and glazing requirements.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for factory-finished doors and frames.
- D. Samples for Verification: For each type of exposed finish required, prepare a sample not less than 3 by 5 inches (75 by 125 mm) and of same thickness and material indicated for final unit of Work.
- E. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.5 QUALITY ASSURANCE

- A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.
- 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-protection ratings indicated, based on testing according to NFPA 252.
1. Test Pressure: Test at atmospheric pressure.
 2. Temperature-Rise Rating: Where indicated, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.
- C. Fire-Rated Window 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 257.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch- (100-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to permit air circulation.

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:

1. Steel Doors and Frames:
 - a. Amweld Building Products, Inc.
 - b. Benchmark Commercial Doors; a division of General Products Co., Inc.
 - c. Ceco Door Products; a United Dominion Company.
 - d. Copco Door Co.
 - e. Curries Company.
 - f. Deansteel Manufacturing, Inc.
 - g. Kewanee Corporation (The).
 - h. Mesker Door, Inc.
 - i. Pioneer Industries Inc.
 - j. Republic Builders Products.
 - k. Steelcraft; a division of Ingersoll-Rand.

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

1. Steel Pre-Finished Knock-Down Frame:
 - a. Timely

2.2 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
- C. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 (ZF120) zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

2.3 DOORS

- A. General: Provide doors of sizes, thicknesses, and designs indicated.
- B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:
 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).
- C. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).
- D. Door Louvers: Provide louvers for doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
 1. Sightproof Louvers: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

- E. Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated.

2.4 FRAMES

- A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Frames of 0.042-inch- (1.0-mm-) (18 GA) thick steel sheet for:
 - 1. Wood doors where prefinished knock down frames are indicated.
- C. Frames of 0.053-inch- (1.3-mm-) (16 GA) thick steel sheet for:
 - 1. Level 2 steel doors.
- D. Frames of 0.067-inch- (1.7-mm-) (14 GA) thick steel sheet for:
 - 1. Level 3 steel doors.
 - 2. Wood doors, unless otherwise indicated.
- E. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.
- F. Plaster Guards: Provide 0.016-inch- (0.4-mm-) thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.
- G. Supports and Anchors: Fabricated from not less than 0.042-inch- (1.0-mm-) thick, electrolytic zinc-coated or metallic-coated steel sheet.
 - 1. Wall Anchors in Masonry Construction: 0.177-inch- (4.5-mm-) diameter, steel wire complying with ASTM A 510 (ASTM A 510M) may be used in place of steel sheet.
- H. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 FABRICATION

- A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
- B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- (1.3-mm-) thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.

- C. Interior Door Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from the following material:
 - 1. Cold-rolled steel sheet, unless otherwise indicated.
 - 2. Metallic-coated steel sheet where indicated.
- D. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.
- E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between pairs of doors. Not more than 3/4 inch (19 mm) at bottom.
- F. Clearances for Fire-Rated Doors: As required by NFPA 80.
- G. Single-Acting, Door-Edge Profile: Square edge.
- H. Double-Acting, Door-Edge Profile: Round vertical edge with 2 1/8" radius.
- I. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- J. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- K. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- L. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.
 - 1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K) or better.
- M. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
- N. Frame Construction: Fabricate frames to shape shown.
 - 1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints, unless otherwise indicated.
 - 2. Fabricate knock-down frames with mitered or coped corners, for field assembly where indicated.
- O. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- P. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.
- Q. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- (0.8-mm-) thick steel sheet.
 - 1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
 - 2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

- R. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.6 FINISHES

- A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.
- B. Factory-Applied Paint Finish: Manufacturer's standard, factory-applied paint finish complying with ANSI A250.3 for performance and acceptance criteria.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range. See Division 1 for definition of "full range". In this case, colors identified by Timely as "pre-matched custom finishes" are included in bidders price.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - 1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
 - 2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
 - 3. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
 - 4. For in-place gypsum board partitions, install knock-down, drywall slip-on frames.
 - 5. Install fire-rated frames according to NFPA 80.
 - 6. For openings 90 inches (2286 mm) or more in height, install an additional anchor at hinge and strike jambs.
- C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
 - 1. Fire-Rated Doors: Install within clearances specified in NFPA 80.
 - 2. Smoke-Control Doors: Install to comply with NFPA 105.

3.2 ADJUSTING AND CLEANING

- A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

SECTION 08211 - FLUSH WOOD DOORS

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. Solid-core doors with wood-veneer, faces.
 - 2. Factory finishing flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Sections include the following:
 - 1. Division 8 Section "Glazing" for glass view panels in flush wood doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, and trim for openings. 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 requirements for veneer matching.
 - 4. Indicate doors to be factory finished and finish requirements.
 - 5. Indicate fire ratings for fire doors.
- C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
 - 1. Faces of Factory-Finished Doors: Show the full range of colors available for stained finishes.
- D. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.
3. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
 1. Test Pressure: Test at atmospheric pressure.
 2. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 17 and 50 percent during the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span.
 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Solid-Core Interior Doors: Life of installation.

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:
 1. Flush Wood Doors:
 - a. Algoma Hardwoods Inc.
 - b. Ampco Products, Inc.
 - c. Buell Door Company.
 - d. Chappell Door Co.
 - e. Eagle Plywood & Door Manufacturing, Inc.
 - f. Eggers Industries; Architectural Door Division.
 - g. GRAHAM Manufacturing Corp.
 - h. Haley Brothers, Inc.
 - i. Ideal Wood Products, Inc.
 - j. IPIK Door Company.
 - k. Lambton Doors.
 - l. Marlite.
 - m. Mohawk Flush Doors, Inc.
 - n. Oshkosh Architectural Door Co.
 - o. Poncraft Door Co.
 - p. Southwood Door Co.
 - q. Vancouver Door Company, Inc.
 - r. VT Industries Inc.
 - s. Weyerhaeuser Company.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Doors for Transparent Finish:
 1. Grade: Custom (Grade A faces).
 2. Species and Cut: White birch, rotary cut (all sapwood).
 3. Match between Veneer Leaves: Book match.
 4. Assembly of Veneer Leaves on Door Faces: Running match.
 5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 6. Stiles: Same species as faces or a compatible species.

2.3 SOLID-CORE DOORS

- A. Particleboard Cores: Comply with the following requirements:
 1. Particleboard: ANSI A208.1, Grade LD-2.

2. Provide doors with structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.

B. Interior Veneer-Faced Doors:

1. Core: Particleboard.
2. Construction: Five plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.
4. Pairs: Furnish formed-steel edges and astragals for pairs of fire-rated doors, unless otherwise indicated.
 - a. Finish steel edges and astragals with baked enamel.

2.4 LOUVERS AND LIGHT FRAMES

- A. Metal Frames for Light Openings in Fire Doors: Manufacturer's standard frame formed of 0.0478-inch-(1.2-mm-) thick, cold-rolled steel sheet; factory finished and approved for use in doors of fire rating indicated.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
1. Light Openings: Trim openings with moldings of material and profile indicated.

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing.
- B. Finish doors at factory.
- C. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.
- D. Finish doors at factory where indicated in schedules or on Drawings as factory finished.
- E. Transparent Finish:
 - 1. Grade: Custom.
 - 2. Finish: Manufacturer's standard finish with performance comparable to AWI System TR-4 conversion varnish.
 - 3. Staining: None required.
 - 4. Effect: Semifilled finish.
 - 5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.

- B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08211

SECTION 08700 - BUILDERS HARDWARE

PART 1 GENERAL:

1.1 Related Documents.

Drawings and general provisions of contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 Description of Work.

- A. Definition: "Builders Hardware" includes items known commercially as builders hardware which is required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frames. Types of items in this section include, but are not necessarily limited to:

1. Hinges
2. Pivots
3. Lock and latch sets
4. Bolts
5. Exit devices
6. Push/Pull Units
7. Closers
8. Overhead holders
9. Miscellaneous door control devices
10. Door trim units
11. Protection plates
12. Thresholds and weatherstrip as listed

- C. The supplier for Builders' Hardware shall have available, at all times, a member of the Door and Hardware Institute, or one of equal competence, to supervise the handling of work under this heading. He shall be a specialist in this work, of long and satisfactory experience, with adequate local storage and service facilities. All finish hardware under this contract shall be furnished and installed by a Supplier who has been established in the contract hardware business in El Paso County for a period of at least five (5) years. There shall be available at all times a qualified hardware consultant to service and supervise the handling of hardware under this contract. The supplier shall maintain an adequate warehouse stock of contract hardware and Locksmith keying facilities in El Paso County for servicing in the project as required as for the owner's continued service after the project is complete.

El Paso, Texas Hardware Supplier/Sub-Contractor that are approved as door and hardware installers and suppliers.

1. Architectural Products Co., Inc. – El Paso, Texas
2. El Paso Steel Doors and Hardware Co. – El Paso, Texas
3. Desert Construction Specialties – El Paso, Texas

- D. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80. Provide only hardware which has been tested and listed by UL for types and sizes of doors required and complies with requirements of door and frame labels.

1.3 Certification.

Authorized Manufacturer's Distributors: Propriety items, locksets, closers, panic exit devices shall be furnished, as specified, for this project by a local factory authorized distributor. The distributor shall maintain, locally, an inventory and be a full-sales and service organization for the manufacturers listed. Compliance with this section shall include letters of certification from the subject manufacturer's certifying the hardware supplier is a factory authorized distributor. Certifications shall be submitted for approval with and be part of the hardware schedule. Hardware schedules will not be considered without the certifications.

- A. Product Data: Submit manufacturer's technical information for each item of hardware. Include whatever information may be necessary to show compliance with requirements and include instructions for installation and for maintenance of operating parts and finish.
- B. Hardware Schedule: Submit final hardware schedule as in manner indicated below. Hardware schedules are intended for coordination of work.
- C. Final Hardware Schedule Content: Based on builders hardware indicated, organize hardware schedule into hardware sets indicating complete designations of every item required for each door or opening. Include the following information:
 - 1. Type, style, function, size and finish of each hardware item.
 - 2. Name and manufacturer of each item.
 - 3. Fastenings and other pertinent information.
 - 4. Location of hardware set cross-referenced to indications on drawings both on floor plans and in door and frame schedule.
 - 5. Explanation of all abbreviations, symbols, codes, etc., contained in schedule.
- D. Prior Approval: Request for substitutions for proprietary items will not be considered for manufacturers other than those listed. Request for substitutions for other items of hardware must be submitted for approval in writing, not less than ten (10) days prior to bid date, no request will be considered after that date.

1.4 Product Handling

- A. Packaging of hardware on a set by set basis is the responsibility of the supplier. As material is received by the hardware supplier from the various manufacturers, sort and repackage in containers marked with the hardware set number. Two or more identical sets may be packed in the same container.
- B. Inventory hardware jointly with representative of the Hardware Supplier Sub-Contractor and the General Contractor until each is satisfied that the count is correct.
- C. Provide secure lock-up for hardware delivered to the project, but not yet installed. Control and handling and installation of hardware items which are not immediately replaceable so that the completion of the work will not be delayed by hardware losses, both before and after installation.

1.5 Job Conditions

- A. Coordination: Coordinate hardware with other work. Tag each item or package separately with identification related to the final hardware schedule and include basic installation instructions in the package. Furnish hardware items of proper design for use on doors and frames of the thickness', profile, swing, security and similar requirements indicated, as necessary, for proper installation and function. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.

- B. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check the shop drawings of such other work, to confirm that adequate provisions are made for the proper installation of hardware.

PART 2: PRODUCTS:

2.1 Scheduled Hardware:

- A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of builders' hardware is indicated in the Builder's Hardware Data Sheet and Hardware Schedule at the end of this section. Products are identified by using hardware designation numbers as follows:
 - 1. Butts and Hinges: Stanley, Hager, McKinney, PBB
 - 2. Locks and Lock Trim: Sargent, Schlage, Yale
 - 3. Closers: Sargent, Norton, LCN
 - 4. Exit Devices: Sargent, Von Duprin, Yale
 - 5. Architectural Door Trim: Trimco, BBW, ALS, APC

2.2 Materials and Fabrication

General:

- A. Hand of door: The drawings show the direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of the door movement as shown.
- B. Base Metals: Produce hardware units of the basic metal and forming method indicated, using the manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for the applicable hardware units by FS-FF-G-111, FS-FF-H-116 and FS-FF-H-121. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.
- C. Fasteners: Manufacture hardware to conform to published templates, generally prepared for machine screw installation.
- D. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match the hardware or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
- E. Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard units of the type specified are available with concealed fasteners.
- F. Tools for Maintenance: Furnish a complete set of specialized tools as needed for Owner's continued adjustment, maintenance, and removal and replacement of builders' hardware.

2.3 Hinges, Butts and Pivots

- A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- B. Screws: Furnish Phillips flat-head all-purpose or machine screws for installation of units, except furnish Phillips flat-head all-purpose or wood screws for installation of units into wood. Finish screw heads to match surface of hinges or pivots.

2.4 Lock Cylinders and Keying

Locks shall be heavy duty lever mortise and cylindrical types as specified.

- A. Cylinders shall be removable core, of the type specified..
- B. Metals: Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver.
- C. Key Material: Provide keys of nickel silver only. Brass keys are not acceptable.
- D. Key Quantity: Furnish three (3) change keys for each lock and the number of master and grand master keys as requested by the Owner.
- E. The Hardware Sub-Contractor shall meet with the Architect and owner's representative to establish and layout the keying requirements. The Architect shall inform the Hardware Sub-Contractor of time and place of the key meeting.

2.5 Locks, Latches and Bolts

- A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt with curved lip extended to protect frame, finished to match hardware set. Provide ASA 4-7/8" strike for metal jambs.
- B. Provide dust-proof strikes for foot bolts as shown in matrix.

2.6 Cabinet Hardware:

- A. All cabinet hardware furnished and installed by the Millwork Contractor.

2.7 Closers and Door Control Devices

- A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit depending upon size of door, exposure to weather and anticipated frequency of use.
- B. Where parallel arms are indicated for closers, provide closer unit one size larger than recommended for use with standard arms.

2.8 Door Trim Units

- A. Push plates and pull plates shall be as specified in the hardware sets.
- B. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units (kickplates, edge trim, viewer, knockers, mail drops and similar units); either machine screws or self-tapping screw.
- C. Fabricate protection plates (armor, kick or mop) not more than 2" on stop side smaller than the door width x the height indicated.

2.9 Hardware Finishes

- A. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce the differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lockset (or push-pull units if no latch/locksets) or color and texture.

- B. Provide finishes which match those established by BHMA or if none established, match the Architect's sample. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than specified for the applicable units of hardware by referenced standards.
- C. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in "Materials & Finishes Standard 1301" by BHMA, including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

PART 3: EXECUTION:

3.1 Installation

- A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may otherwise be directed by the Architect.
- B. Hardware and Sub-Contractor: A mandatory requirement is for the hardware supplier to install all steel and wood doors and all finish hardware (not including aluminum entry system doors or cabinet hardware), and this firm have complete responsibility for all the doors and hardware. Hardware sub-contractor shall be a local firm regularly engaged in the installation of doors and hardware, second tier sub-contract installers will not be permitted.
- C. While the following hardware schedule is intended to cover all doors, not including hardware (except for cylinders) for aluminum doors, overhead doors, and other speciality doors normally furnished as a complete unit with hardware. The hardware schedule is intended to establish a type and quality standard for all finish hardware requirements for all openings in this project whether listed or not. It is the specific duty of the finish hardware supplier to examine the plans and specifications and furnish proper hardware for all opening whether listed or not. This shall include any and all necessary hardware to comply with the ADA and local and national building codes applicable at the time the project is bid. If there are any omissions in the hardware groups in regard to regular doors, they shall be called to the attention of the Architect prior to bid opening, for instructions: otherwise the list will be considered complete. **No extras will be allowed.**
- D. It is the responsibility of the electrical sub-contractor to provide all j-boxes, conduit, and power for all electrified hardware called out in this specification.

3.2 Adjust and Clean

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

- B. AMERICA'S WITH DISABILITIES ACT OF 1990 ELIMINATION OF ARCHITECTURAL BARRIERS:

Exterior hinged doors shall not exceed 8.5 lbf. Slight increases in opening force shall be allowed where 8.5 lbf. is insufficient to compensate for air pressure differentials.

Sliding doors, folding doors, and interior hinged doors shall not require a force exceeding 5 lbs.

Fire doors may be adjusted to meet the minimum opening force allowed by the governing authority or applicable building code.

All doors shall have lever handles.

The Americans with Disabilities Act of 1990 shall be considered the governing consideration.

END OF SECTION

SECTION 09253 - GYPSUM SHEATHING

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. Paper-surfaced type 'X' gypsum sheathing board.
 - 2. Glass-mat gypsum sheathing board.
 - 3. Sheathing joint-and-penetration treatment.
- B. Related Sections include the following:
 - 1. Division 7 Section Sheet Metal Flashing and Trim for flashing installed with gypsum sheathing.
 - 2. Division 7 Section Joint Sealants for sealants applied with gypsum sheathing.
 - 3. Division 9 Section Gypsum Board Assemblies for steel framing and interior gypsum panels incorporated into assemblies with gypsum sheathing on the exterior.

1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology Standard: Refer to ASTM C 11 for definitions of terms for gypsum sheathing board construction not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Building Wrap: For air/moisture-infiltration protection, include data substantiating compliance with building code in effect for Project.

1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, or other causes. Stack sheathing flat on leveled supports off the ground, under cover, and fully protected from weather.

1.7 COORDINATION

- A. Paper-Surfaced Gypsum Sheathing Board:

1. Do not leave exposed to weather for more than 30 days.
2. Do not leave exposed to weather for more than 30 days when unprotected or for more than 180 days when protected as required in Part 3 "Protection" Article.

- B. Glass-Mat Gypsum Sheathing Board:

1. Do not leave exposed to weather for more than 180 days.

END OF SECTION 09253

SECTION 09260 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior gypsum wallboard.
2. Exterior gypsum board panels for ceilings and soffits.
3. Tile backing panels.
4. Non-load-bearing steel framing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, 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 (Z180), hot-dip galvanized zinc coating.

B. Suspended Ceiling and Soffit Framing:

1. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
2. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
3. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch (1.37 mm), a minimum 1/2-inch- (12.7-mm-) wide flange, and in depth indicated.

4. Furring Channels (Furring Members):
 - a. Cold Rolled Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange, 3/4 inch (19.1 mm) deep.
 - b. Steel Studs: ASTM C 645, in depth indicated.
 - 1) Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
- C. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 1. Available Products:
 - a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
 - b. USG Interiors, Inc.; Drywall Suspension System.
- D. Partition and Soffit Framing:
 1. Steel Studs and Runners: ASTM C 645, in depth indicated.
 - a. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
 2. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch- (50.8-mm-) deep flanges.
 3. Proprietary Firestop Track: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Available Products:
 - 1) Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
 - 2) Metal-Lite, Inc.; The System.
 4. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - a. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
 5. Hat-Shaped, Rigid Furring Channels: ASTM C 645, in depth indicated.
 - a. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
 6. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange, and in depth indicated.
 - a. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

7. 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 Wallboard: ASTM C 36.
 1. Regular Type: In thickness indicated and with long edges tapered.
 2. Type X: In thickness indicated and with long edges tapered.
- C. Sag-Resistant Gypsum Wallboard: ASTM C 36, manufactured to have more sag resistance than regular-type gypsum board, 1/2 inch (12.7 mm) thick, and with long edges tapered. Apply on ceiling surfaces.
- D. Exterior Gypsum Panels for Ceilings and Soffits:
 1. Exterior Gypsum Soffit Board: ASTM C 931/C 931M, with core type and in thickness indicated and with manufacturer's standard edges.
- E. Tile Backing Panels:
 1. Cementitious Backer Units: ANSI A118.9, in thickness indicated.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 1. Cornerbead: Use at outside corners.
 2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use where indicated.
 4. U-Bead: Use where indicated.
 5. Expansion (Control) Joint: Use where indicated.
 6. Curved-Edge Cornerbead: With notched or flexible flanges; use at curved openings.
- B. Exterior Trim: ASTM C 1047, hot-dip galvanized steel sheet or rolled zinc.
 1. 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. Exterior Gypsum Soffit Board: Paper.
 3. 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.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
- D. Joint Compound for Exterior Applications:
1. Exterior Gypsum Soffit Board: Use setting-type taping and setting-type, sandable topping compounds.
- E. Joint Compound for Tile Backing Panels:
1. Cementitious Backer Units: As recommended by manufacturer.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Available Products:
 - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
- C. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
1. Available Products:
 - a. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
 - b. Pecora Corp.; BA-98.
 - c. Tremco, Inc.; Tremco Acoustical Sealant.
- D. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

E. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

F. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

2.7 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.

1. Available Products:

- a. United States Gypsum Co.; SHEETROCK Wall and Ceiling Spray Texture (Aggregated).

2. Texture: Light-spatter.

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:

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 complying 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 doorframes; 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 (304.8 mm) o.c. for vertical applications.
2. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) 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 (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of board.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
5. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

- B. Exterior Ceilings and Soffits: Apply exterior gypsum panels perpendicular to supports, with end joints staggered and located over supports.

- 1. Fasten with corrosion-resistant screws.

- C. Tile Backing Panels:

- 1. Cementitious Backer Unit Application: ANSI A108.11.

3.3 FINISHING

- A. 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.

- B. Finishing Gypsum Board Panels: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required preparing gypsum board surfaces for decoration.

- 1. Prefill open joints, rounded or beveled edges, and damaged surface areas.
 - 2. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
 - 3. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
 - 4. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

- C. Cementitious Backer Units: Finish according to manufacturer's written instructions.

- 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 panel surfaces that will be exposed to view, unless otherwise indicated.

3.4 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture finish manufacturer's written recommendations.

END OF SECTION 09260

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. This Section includes the following:

1. Ceramic mosaic tile.
2. Quarry tile.
3. Paver tile.
4. Glazed wall tile.
5. Waterproof membrane for thin-set tile installations.
6. Stone thresholds installed as part of tile installations.

- B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
2. Division 7 Section "Self-Adhering Sheet Waterproofing" for waterproofing under thickset mortar beds.
3. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
4. Division 9 Section "Gypsum Board Assemblies" for cementitious backer units installed in gypsum wallboard assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.

- B. Load-Bearing Performance: For ceramic tile installed on walkway surfaces, provide installations rated for the following load-bearing performance level based on testing assemblies according to ASTM C 627 that are representative of those indicated for this Project:

1. Moderate: Passes cycles 1 through 10.

1.4 SUBMITTALS

- A. Product Data: For each type of tile, mortar, grout, and other products specified.
- B. Grout Samples for Initial Selection: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.
- C. Samples for Verification: Of each item listed below, prepared on Samples of size and construction indicated. Where products involve normal color and texture variations, include Sample sets showing the full range of variations expected.
 - 1. Each type and composition of tile and for each color and texture required, at least 12 inches (300 mm) square, mounted on braced cementitious backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Architect.
 - 2. Full-size units of each type of trim and accessory for each color required.
 - 3. Stone thresholds in 6-inch (150-mm) lengths.
- D. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.
- E. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of architects and owners, and other information specified.
- F. Setting Material Test Reports: Indicate and interpret test results for compliance of tile-setting and -grouting products with specified requirements.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Source Limitations for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.
- C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- D. Source Limitations for Other Products: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:
 - 1. Stone thresholds.
 - 2. Waterproofing.
- E. Mockups: Before installing tile, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.
 - 1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect 7 days in advance of the 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 proceeding with final unit of Work.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - a. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.6 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 requirement of ANSI A137.1 for labeling sealed tile packages.
- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.
- C. Handle tile with 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.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.8 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide products indicated in the ceramic tile installation schedules at the end of this Section.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Tile-Setting and -Grouting Materials:
 - a. American Olean Tile Company.
 - b. Atlas Minerals & Chemicals, Inc.
 - c. Boiardi Products Corporation.

- d. Bonsal: W.R. Bonsal Company.
- e. Bostik.
- f. C-Cure Corporation.
- g. Custom Building Products.
- h. Dal-Tile Corporation.
- i. DAP, Inc.
- j. Laticrete International, Inc.
- k. Mapei Corporation.
- l. Southern Grouts & Mortars, Inc.
- m. Summitville Tiles, Inc.
- n. TEC Incorporated.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," 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 standards referenced in "Setting Materials" and "Grouting Materials" articles.
- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
 - 1. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated (for items not preselected).
 - 2. Provide tile trim and accessories that match color and finish of adjoining flat tile.
- D. Factory Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.
- E. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.
 - 1. Where tile is indicated for installation in swimming pools, on exteriors, or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for these kinds of installations and has a record of successful in-service performance.
- F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

- A. Unglazed Ceramic Mosaic Tile: Provide factory-mounted flat tile complying with the following requirements:

1. Composition: Porcelain with abrasive admixture.
2. Module Size: 2 by 2 inches (50.8 by 50.8 mm).
3. Nominal Thickness: 1/4 inch (6.35 mm).
4. Face: Plain with cushion edges.

B. Unglazed Quarry Tile: Provide square-edged flat tile complying with the following requirements:

1. Wearing Surface: Abrasive aggregate embedded in surface.
2. Facial dimensions 7 5/8 inches x 7 5/8 inches.
3. Thickness: 1/2 inch (12.7 mm).
4. Face: Plain.

C. Unglazed Paver Tile: Provide flat tile complying with the following requirements:

1. Composition: Porcelain.
2. Facial Dimensions: 11-3/4 by 11-3/4 inches.
3. Thickness: 5/16 inch (6.35 mm).
4. Face: Plain with cushion edges.
5. For latex-portland cement mortared and grouted paver tile, precoat with temporary protective coating.

D. Glazed Wall Tile: Provide flat tile complying with the following requirements:

1. Module Size: 6 by 6 inches (152 by 152 mm).
2. Thickness: 5/16 inch (8 mm).
3. Face: Plain with cushion edges.

E. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:

1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
2. Shapes: As follows, selected from manufacturer's standard shapes:
 - a. Base for Thin-Set Mortar Installations: Coved.
 - b. External Corners for Thin-Set Mortar Installations: Surface bullnose.
 - c. Internal Corners: Field-butt square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.
 - d. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide a reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.35 mm) across nominal 4-inch (100-mm) dimension.

2.4 STONE THRESHOLDS

A. General: Provide stone thresholds that are uniform in color and finish, fabricated to sizes and profiles indicated to provide transition between tile surfaces and adjoining finished floor surfaces.

1. Fabricate thresholds to heights indicated, but not more than 1/2 inch (12.7 mm) above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2.

- B. Granite Thresholds: Provide granite thresholds complying with ASTM C 615 requirements.

2.5 WATERPROOFING FOR THIN-SET TILE INSTALLATIONS

- A. General: Provide products that comply with ANSI A118.10 and the descriptions in this Article.
- B. Latex-Rubber Waterproofing: Manufacturer's standard factory-packaged, job-mixed, proprietary, 2-part formulation consisting of liquid-latex rubber and powder for trowel application and glass-fiber-fabric reinforcing.
- C. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Latex-Rubber Waterproofing:
 - a. Trowel & Seal Waterproof Membrane; Custom Building Products.

2.6 SETTING MATERIALS

- A. Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1A and as specified below:
 - 1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15), or polyethylene sheeting ASTM D 4397, 4.0 mils (0.1 mm) thick.
 - 2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82, except for minimum wire size.
 - 3. Latex additive (water emulsion) described below, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with job-mixed portland cement and aggregate mortar bed.
 - a. Latex Additive: Styrene butadiene rubber.
- B. Latex-Portland Cement Mortar: ANSI A118.4, composed as follows:
 - 1. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.
 - a. For wall applications, provide nonsagging, latex-portland cement mortar complying with ANSI A118.4 for mortar of this type defined in Section F-2.1.2.

2.7 GROUTING MATERIALS

- A. Latex-Portland Cement Grout: ANSI A118.6 for materials described in Section H-2.4, composed as follows:
 - 1. Factory-Prepared, Dry-Grout Mixture: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to produce the following:

- a. Unsanded grout mixture for joints 1/8 inch (3.2 mm) and narrower.
- b. Sanded grout mixture for joints 1/8 inch (3.2 mm) and wider.

2.8 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. 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.

2.9 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 from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards 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 before installing tile.
 - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.
- B. Provide concrete substrates for tile floors installed with dry-set or latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.

1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.
 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. 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.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
1. For tile mounted in sheets, make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished work.
- F. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Locate joints in tile surfaces directly above joints in concrete substrates.
- G. Grout tile to comply with the requirements of the following tile installation standards:
1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.

3.4 WATERPROOFING INSTALLATION

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

1. Comply with testing requirements for division 7 section for sheet waterproofing.

3.5 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Ceramic Tile Floor Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.
- B. Joint Widths: Install tile on floors with the following joint widths:
 1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
 2. Quarry Tile: 3/8 inch (9.5 mm).
 3. Paver Tile: 1/4 inch (6.35 mm).
- C. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.
 1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.
 - a. Locate at transition between paver tile (12"x12") and ceramic mosaic tile (2"x2").
 - b. Locate at transition between carpet and ceramic mosaic tile (2"x2").

3.6 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- B. Joint Widths: Install tile on walls with the following joint widths:
 1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
 2. Wall Tile: 1/16 inch (1.6 mm), U.N.O.
 3. At 12"x12" wall tile = 1/4".
- C. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
 1. Tile wall installations (includes all tile above area covered by shower pan.)
 2. Tile wall installations composed of tiles 8 by 8 inches (203 by 203 mm) or larger.

3.7 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 latex-portland cement grout residue from tile as soon as possible.
 2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal

- surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
- C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion.
1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
 2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.8 CERAMIC TILE FLOOR INSTALLATION SCHEDULE

- A. Ceramic Tile Floor Installation: Where exterior floor installations are indicated, comply with the following:
1. Tile Type/Products: Unglazed paver tile. Provide the following products:
 - a. Crossville; A790, burgundy smoke, Surface: flamed stone (includes base).
 2. Installation Method: TCA F121 (cement mortar bed bonded to waterproof membrane over concrete subfloor).
 3. Setting Bed and Grout: ANSI A108.1A with the following grout:
 - a. Sanded latex-portland cement grout.
- B. Ceramic Tile Floor Installation CT: Where interior floor installations of this designation are indicated, comply with the following:
1. Tile Type/Products: Unglazed paver tile. Provide the following products:
 - a. Crossville; A246, Pacific surf, Surface: unpolished (field tile).
 - b. Crossville; A900, mica, Surface: unpolished (border and base).
 2. Installation Method: TCA F122 (thin-set mortar bonded to waterproof membrane over concrete slab).
 3. Setting Bed and Grout: ANSI A108.5 with the following mortar and grout:
 - a. Latex-portland cement mortar.
 - b. Sanded latex-portland cement grout.
- C. Ceramic Tile Floor Installation CM: Where interior floor installations of this designation are indicated, comply with the following:
1. Tile Type/Products: Unglazed, ceramic mosaic tile. Provide the following products:

- a. Dal Tile; keystones, white with abrasive, D137
 2. Installation Method: TCA F122 (thin-set mortar bonded to waterproof membrane over concrete slab).
 3. Setting Bed and Grout: ANSI A108.5 with the following mortar and grout:
 - a. Latex-portland cement mortar.
 - b. Unsanded latex-portland cement grout.
- D. Ceramic Tile Floor Installation QT: Where interior floor installations of this designation are indicated, comply with the following:
1. Tile Type/Products: Unglazed quarry tile. Provide one of the following products:
 - a. Metropolitan ceramics; 15X Malibu Beach.
 2. Installation Method: TCA F122 (thin-set mortar bonded to waterproof membrane over concrete slab).
 3. Setting Bed and Grout: ANSI A108.5 with the following mortar and grout:
 - a. Latex-portland cement mortar.
 - b. Sanded latex-portland cement grout.

3.9 CERAMIC TILE WALL INSTALLATION SCHEDULE

- A. Ceramic Tile Wall Installation: Where wall installations, other than at water coolers, are indicated, comply with the following:
1. Tile Type/Products: Glazed wall tile. Provide the following products:
 - a. Dal Tile; Biscuit K175 (wall and base).
 2. Installation Method: TCA W202 (thin-set mortar bed over sound, dimensionally stable masonry or concrete).
 3. Setting Bed and Grout: ANSI A108.5 with the following mortar and grout:
 - a. Latex-portland cement mortar.
 - b. Unsanded latex-portland cement grout.
- B. Ceramic Tile Wall Installations: Where interior wall installations, other than at water coolers, are indicated, comply with the following:
1. Tile Type/Products: Glazed wall tile. Provide the following products:
 - a. Dal Tile; Biscuit K175 (wall and base).
 2. Installation Method: TCA W244 (thin-set mortar bonded to cementitious backer units on metal studs).

3. Setting Bed and Grout: ANSI A108.5 with the following mortar and grout:
 - a. Latex-portland cement mortar.
 - b. Unsanded latex-portland cement grout.
- C. Ceramic Tile Wall Installations: Where interior wall installations are noted at water cooler alcoves, comply with the following:
 1. Tile Type/Products: Unglazed porcelain. Provide the following products:
 - a. Crossville; A900, mica, polished (12 x 12).
 2. Installation Method: TCA W244 (thin-set mortar bonded to cementitious backer units on metal studs.
 3. Setting Bed and Grout: ANSI A108.5 with the following mortar and grout:
 - a. Latex-portland cement mortar.
 - b. Sanded latex-portland cement grout.
- D. Ceramic Tile Wall Installation: Where interior wall and shower-receptor installations are indicated, comply with the following:
 1. Tile Type/Products: Unglazed ceramic mosaic tile and glazed wall tile. Provide the following products:
 - a. Dal Tile; biscuit, K175 (wall and base).
 - b. Dal Tile; white and abrasive, D137 (floor).
 2. Installation Method: TCA B415 and TCA W244 (shower receptor with thin-set mortar bonded to cementitious backer units over metal studs on walls).
 3. Setting Bed and Grout: ANSI A108.5 with the following mortar and grout:
 - a. Latex-portland cement mortar.
 - b. Unsanded latex-portland cement grout.

END OF SECTION 09310

SECTION 09511 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.

1.3 DEFINITIONS

- A. AC: Articulation Class.
- B. CAC: Ceiling Attenuation Class.
- C. LR: Light Reflectance coefficient.
- D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- (150-mm-) square. Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.
- C. Qualification Data: For testing agency.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.
- E. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor type.
- F. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according

to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

D. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.

E. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.8 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- C. Panel-Based Antimicrobial Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial solution that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.

2.3 WATER-FELTED, MINERAL-BASE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING AP-1

- A. Available Products:
 - 1. Armstrong; Cortega, 2195
- B. Classification: Provide panels complying with ASTM E 1264 for Type III, mineral base with painted finish; Form 2, water felted; and pattern as follows:

1. Pattern: C (perforated, small holes) & D (fissured).
 - C. Color: White.
 - D. LR: Not less than 0.80.
 - E. NRC: Not less than 0.55.
 - F. CAC: Not less than 35.
 - G. Edge Detail: Beveled tegular.
 - H. Thickness: 5/8 inch (15 mm).
 - I. Size: 24 by 24 inches (610 by 610 mm).
 - J. Antimicrobial Treatment: Panel based.
- 2.4 HIGH-DENSITY, CERAMIC- AND MINERAL-BASE ACOUSTICAL PANELS WITH SCRUBBABLE FINISH FOR ACOUSTICAL PANEL CEILING AP-2:
- A. Available Products:
 1. Armstrong; Ceramaguard, 605.
 - B. Classification: Provide panels complying with ASTM E 1264 for Type XX, other types; described as high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.
 1. Pattern: G (smooth).
 - C. Color: White.
 - D. LR: Not less than 0.80.
 - E. NRC: Not less than 0.10.
 - F. CAC: Not less than 40.
 - G. Edge Detail: Square.
 - H. Thickness: 5/8 inch (15 mm).
 - I. Size: 24 by 48 inches (610 by 1220 mm).
- 2.5 METAL SUSPENSION SYSTEMS, GENERAL
- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
 - 1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
 - C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
 - 1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
 - D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.
 - E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
 - F. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.
 - G. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.
- 2.6 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING AP-1.
- A. Available Products:
 - 1. Armstrong; Suprafine ML
 - B. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/653M, not less than G30 (Z90) coating designation, with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.
 - 1. Structural Classification: Intermediate-duty system.
 - 2. End Condition of Cross Runners: Butt-edge type.
 - 3. Face Design: Flat, flush
 - 4. Cap Material: Steel cold-rolled sheet.
 - 5. Cap Finish: Painted white.
- 2.7 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING AP-2.
- A. Available Products:

1. Armstrong; Prelude MX
 - B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
 1. Structural Classification: Intermediate-duty system.
 2. End Condition of Cross Runners: Override (stepped) type.
 3. Face Design: Flat, flush.
 4. Cap Material: Steel cold-rolled sheet.
 5. Cap Finish: Painted white.
- 2.8 ACOUSTICAL SEALANT
- A. Available Products:
 1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corp; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
 2. Acoustical Sealant for Concealed Joints:
 - a. OSI Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
 - b. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
 - c. Pecora Corp.; BA-98.
 - d. Tremco, Inc.; Tremco Acoustical Sealant.
 - B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - C. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 6. Do not attach hangers to steel deck tabs.
 - 7. Do not attach hangers to steel roof deck. Attach hangers to structural members. If member spacing is too great use trapezes per No.3 above.
 - 8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.66 m). Miter corners accurately and connect securely.
 - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - 1. Arrange directionally patterned acoustical panels as follows:

- a. Install panels with pattern running in one direction parallel to long axis of space.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
5. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction and in spaces as recommended by panel manufacturer's written instructions, unless otherwise indicated.
 - a. Additionally install: Within 20'-0" of exterior doors & operable windows.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09511

SECTION 09651 - RESILIENT FLOOR 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. This Section includes the following:
 - 1. Vinyl composition tile (VCT).

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.
- D. Maintenance Data: For resilient products to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Close spaces to traffic during floor covering installation.

- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
 - 2. Resilient Wall Base and Accessories: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products listed in other Part 2 articles.
- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 COLORS AND PATTERNS

- A. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 VINYL COMPOSITION TILE.

- A. Vinyl Composition Tile (VCT): ASTM F 1066.
 - 1. AB ColorPlus, American Biltrite (Canada) Ltd.
 - 2. Armstrong World Industries, Inc.
 - 3. Azrock Commercial Flooring, DOMCO.
 - 4. Congoleum Corporation.
 - 5. Mannington Mills, Inc.
 - 6. Tarkett Inc.
- B. Class: 1 (solid-color tile) and 2 (through-pattern tile).
- C. Wearing Surface: Smooth.
- D. Thickness: 0.125 inch (3.2 mm).
- E. Size: 12 by 12 inches (305 by 305 mm).
- F. Fire-Test-Response Characteristics:
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.4 RESILIENT WALL BASE

A. Wall Base: ASTM F 1861.

1. AFCO-USA, American Floor Products Company, Inc.
2. Armstrong World Industries, Inc.
3. Azrock Commercial Flooring, DOMCO
4. Burke Mercer Flooring Products
5. Endura
6. Estrie, American Biltrite (Canada) Ltd.
7. Johnsonite
8. Marley Flexco (USA), Inc.
9. Mondo Rubber International, Inc.
10. Musson, R. C. Rubber Co.
11. Nora Rubber Flooring, Freudenberg Building Systems, Inc.
12. Pirelli Rubber Flooring
13. Roppe Corporation
14. Stoler Industries
15. VPI, LLC, Floor Products Division

B. Type (Material Requirement): TV (vinyl).

C. Group (Manufacturing Method): I (solid).

D. Style: Cove (with top-set toe).

E. Minimum Thickness: 0.125 inch (3.2 mm).

F. Height: 4 inches (102 mm).

G. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.

H. Outside Corners: Job formed or premolded.

I. Inside Corners: Job formed or premolded.

J. Surface: Smooth.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 3. Moisture Testing:
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
- E. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- F. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - 1. Do not install resilient products until they are same temperature as space where they are to be installed.
- G. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated.

- B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles in pattern of colors and sizes indicated.
- C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- D. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Premolded Corners: Install premolded corners before installing straight pieces.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.5 RESILIENT ACCESSORY INSTALLATION

- A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.6 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
 - a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
 - 1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
 - a. Use commercially available product acceptable to manufacturer.
 - b. Coordinate selection of floor polish with Owner's maintenance service.
 - 2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
 - 3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION 09651

SECTION 09653 - RESILIENT WALL BASE AND ACCESSORIES

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. Wall base.
 - 2. Molding accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide resilient stair accessories with a critical radiant flux classification of Class I, not less than 0.45 W/sq. cm, as determined by testing identical products per ASTM E 648 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.

- B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- C. Install resilient products after other finishing operations, including painting, have been completed (carpet installation excepted).

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

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 COLORS AND PATTERNS

- A. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 RESILIENT WALL BASE

- A. Wall Base: ASTM F 1861.
 - 1. Johnsonite: TightLock Carpet (use TightLock Resilient at conc. and tile floors where resilient base is noted)
- B. Type (Material Requirement): TV (vinyl).
- C. Group (Manufacturing Method): I (solid).
- D. Style: Straight (toeless).
- E. Height: 3 1/4 inches.
- F. Lengths: Coils in manufacturer's standard length.
- G. Outside Corners: Premolded.
- H. Inside Corners: Premolded.
- I. Surface: Smooth.

2.4 RESILIENT MOLDING ACCESSORY

- A. Description: Joiner for tile and carpet.
 - 1. Johnsonite; CCA-XX.
- B. Description: Conc. to tile transition.
 - 1. CTA-XX-J
- C. Description: Conc. to carpet transition.
 - 1. EG-XX-G
- D. Material: Vinyl.
- E. Profile and Dimensions: As indicated.

2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturers for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

- D. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - 1. Do not install resilient products until they are the same temperature as the space where they are to be installed.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Premolded Corners: Install premolded corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.
 - 1. Install products listed in part 2 at corresponding conditions, U.N.O.

3.5 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
 - a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION 09653

SECTION 09912 - PAINTING (PROFESSIONAL LINE PRODUCTS)

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Dunn-Edwards Paints.
 - 2. Kelly-Moore Paint Co. (Kelly-Moore).
 - 3. M. A. Bruder & Sons, Inc. (M. A. B. Paint).
 - 4. PPG Industries, Inc. (Pittsburgh Paints).
 - 5. Sherwin-Williams Co. (Sherwin-Williams).
 - 6. Kwal Paint

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
- C. Colors: Match samples.

2.3 PREPARATORY COATS

- A. Exterior Primer: Exterior alkyd or latex-based primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.

1. Ferrous-Metal and Aluminum Substrates: Rust-inhibitive metal primer.
 2. Zinc-Coated Metal Substrates: Galvanized metal primer.
 3. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.
- B. Interior Primer: Interior latex-based or alkyd primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
1. Ferrous-Metal Substrates: Quick drying, rust-inhibitive metal primer.
 2. Zinc-Coated Metal Substrates: Galvanized metal primer.
 3. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.

2.4 EXTERIOR FINISH COATS

- A. Exterior Low-Luster Acrylic Paint:
1. Dunn-Edwards; Acrylic Exterior Flat, Concrete Block Filler
 2. Sherwin-Williams; A-100 Exterior Latex Satin House & Trim Paint A82 Series.
- B. Interior Low-Luster Acrylic Enamel:
1. Dunn-Edwards; Acrylic Exterior Flat, Concrete Block Filler
 2. Sherwin-Williams;

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with procedures specified in PDCA P4 for inspection and acceptance of surfaces to be painted.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
- C. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- D. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
 2. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
 - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to [SSPC-SP 6/NACE No. 3] [SSPC-SP 10/NACE No. 2].
 - b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
 3. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- E. Material Preparation:
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
- F. Exposed Surfaces: Include areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
1. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 2. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 3. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 4. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
- G. Sand lightly between each succeeding enamel or varnish coat.
- H. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Omit primer over metal surfaces that have been shop primed and touchup painted.
 2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.

- I. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
- J. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
- K. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- L. Prime Coats: 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. 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.
- M. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

3.2 CLEANING AND PROTECTING

- A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
- B. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- C. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.3 EXTERIOR PAINT SCHEDULE

- A. Exterior Gypsum Soffit Board:
 - 1. Acrylic Finish: Two finish coats over an exterior alkyd- or alkali-resistant primer.
 - a. Primer: Exterior gypsum soffit board primer.
 - b. Finish Coats: Exterior low-luster acrylic paint.
- B. Ferrous Metal:
 - 1. Acrylic Finish: Two finish coats over a rust-inhibitive primer.
 - a. Primer: Exterior ferrous-metal primer (not required on shop-primed items).

- b. Finish Coats: Exterior low-luster acrylic paint..

C. Zinc-Coated Metal:

- 1. Acrylic Finish: Two finish coats over a galvanized metal primer.
 - a. Primer: Exterior galvanized metal primer.
 - b. Finish Coats: Exterior low-luster acrylic paint.

3.4 INTERIOR PAINT SCHEDULE

A. Gypsum Board:

- 1. Acrylic Finish: Two finish coats over a primer.
 - a. Primer: Interior gypsum board primer.
 - b. Finish Coats: Interior low-luster acrylic enamel.

B. Ferrous Metal:

- 1. Acrylic Finish: Two finish coats over a primer.
 - a. Primer: Interior ferrous-metal primer.
 - b. Finish Coats: Interior low-luster acrylic enamel.

C. Zinc-Coated Metal:

- 1. Acrylic Finish: Two finish coats over a primer.
 - a. Primer: Interior zinc-coated metal primer.
 - b. Finish Coats: Interior low-luster acrylic enamel.

END OF SECTION 09912

SECTION 09963 - ELASTOMERIC COATINGS

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 surface preparation and application of elastomeric coatings to exterior surfaces.
- B. Alternates: Refer to Division 1 Section "Alternates" for description of Work in this Section affected by alternates.

1.3 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
- B. Stucco: A portland cement-based plaster used on exterior surfaces.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric coatings that comply with performance requirements specified in MPI 113.
- B. Provide elastomeric coating systems with the following properties as determined by test methods indicated:
 - 1. Elongation: Not less than 100 percent with a tensile strength of 200 psi (1379 kPa) and not less than 88 percent recovery after 1 hour and 90 percent recovery after 24 hours when tested according to ASTM D 2370 using parameters established by MPI 113.
 - 2. Accelerated Weathering: No cracking, peeling, blistering, chalking, or visual deterioration after 1000 hours when tested according to procedures in ASTM G 155.
 - 3. Low-Temperature Flexibility: No crack formation when tested according to ASTM D 1737.
 - 4. Moisture-Vapor Transmission: Not less than 2.0 perms (115 ng/Pa x s x sq. m) according to ASTM D 1653.
 - 5. Wind-Driven Rain Resistance: No water penetration according to procedures in FS TT-C-555.
 - 6. Minimum Solids Content by Volume: Not less than 45 percent.

1.5 SUBMITTALS

- A. Product Data: For each elastomeric coating system specified. Include crack fillers, block fillers, and primers.

1. **Material List:** An inclusive list of required coating materials. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 2. **Manufacturer's Information:** Technical information including label analysis and instructions for handling, storing, and applying each coating material.
 3. **Certification** by elastomeric coating manufacturer that products supplied comply with local VOC regulations.
- B. **Samples for Initial Selection:** For each type of finish-coat material indicated.
1. After color selection, Architect will furnish color chips indicating colors selected.
- C. **Samples for Verification:** For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of actual substrate.
1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
 2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
 3. Submit 2 Samples on the following substrates for Architect's review of color and texture only:
 - a. Concrete, Masonry, and Stucco: 4-by-6-inch[100-by-150-mm] Samples of actual substrate material for each color and texture.
 - b. Concrete Unit Masonry: 4-by-8-inch (100-by-200-mm) rectangular Samples of concrete masonry, with mortar joint in the center, for each color and texture.
- D. **Qualification Data:** For Applicator.
- E. **Material Certificates:** For each elastomeric coating material, signed by manufacturers.
- F. **Product Test Reports:** Based on evaluation of comprehensive tests by a qualified testing agency for each elastomeric coating material indicating compliance of elastomeric coatings with requirements based on comprehensive testing within the last five years of current product formulations.

1.6 QUALITY ASSURANCE

- A. **Applicator Qualifications:** A firm or individual experienced in applying elastomeric coating systems similar in material and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. **Source Limitations:** Obtain crack fillers, block fillers, primers and other undercoat materials from same manufacturer as finish coats.
- C. **Benchmark Samples (Mockups):** Provide full-coat benchmark finish samples for each type of coating on each substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample submittals.

1. Architect will select one stucco exterior wall surface to represent surfaces and conditions for application of elastomeric coatings.
 - a. Wall Surfaces: Prepare samples on at least 100 sq. ft. of wall surface.
2. Apply benchmark samples according to requirements for the completed Work. Provide required sheen, color, and texture on each surface.
3. Approved benchmark samples will be used to evaluate coating systems.
4. Obtain Architect's approval of benchmark samples before starting application of coatings.
5. Final approval of colors will be from benchmark samples.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 1. Product name or title of material.
 2. Manufacturer's stock number and date of manufacture.
 3. Contents by volume, for pigment and vehicle constituents.
 4. Thinning instructions (if permitted).
 5. Application instructions.
 6. Color name and number.
 7. Handling instructions and precautions.
 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.
 1. Protect elastomeric coating materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.8 PROJECT CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C), unless otherwise permitted by manufacturer's written instructions.
- B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
 1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before starting or continuing coating operation.

1.9 WARRANTY

- A. Elastomeric Coating Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace elastomeric coatings that fail within specified warranty period. Failures include, but are not limited to, water penetration through the coating.

- B. Warranty Period for Elastomeric Coatings: (10) ten year(s) from date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Furnish extra elastomeric coating materials from same production run as materials applied and in quantities described below. Package materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to Owner.
 - 1. Quantity: Furnish Owner with 2 gal. (7.5 L) of each color and finish of elastomeric coating materials applied.
 - 2. Quantity: Furnish Owner with an additional 5 percent, but not less than 1 gal. (3.8 L) or 1 case, as appropriate, of each color applied.

END OF SECTION 09963

SECTION 10520 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Portable fire extinguishers.
 - 2. Mounting brackets for fire extinguishers.
 - 3. Owner-Furnished Material: Fire extinguishers.
- B. See Division 9 painting Sections for field painting fire-protection cabinets.
- C. See Division 13 Section "Fire-Suppression Piping" for hose systems, racks, and valves.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Fire Extinguishers: Include rating and classification.
 - 2. Fire-Protection Cabinets: Include door hardware, cabinet type, trim style, panel style, and details of installation.
 - 3. Show location of knockouts for hose valves.
- B. Samples: For each exposed cabinet finish.
- C. Maintenance data.

1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- C.

1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Apply decals on field-painted fire-protection cabinets after painting is complete.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

END OF SECTION 10520

SECTION 15050 - BASIC 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Concrete base construction requirements.
 - 3. Escutcheons.
 - 4. Dielectric fittings.
 - 5. Flexible connectors.
 - 6. Mechanical sleeve seals.
 - 7. Equipment nameplate data requirements.
 - 8. Labeling and identifying mechanical systems and equipment is specified in Division 15 Section "Mechanical Identification."
 - 9. Nonshrink grout for equipment installations.
 - 10. Field-fabricated metal and wood equipment supports.
 - 11. Installation requirements common to equipment specification sections.
 - 12. Mechanical demolition.
 - 13. Cutting and patching.
 - 14. Touchup painting and finishing.
- B. Pipe and pipe fitting materials are specified in Division 15 piping system Sections.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and 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 SUBMITTALS

- A. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work.
- B. Samples: When requested, provide physical sample of component or equipment for review.

1.5 QUALITY ASSURANCE

- A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be the responsibility of submitting entity. The energy ratings or efficiencies of equipment must meet design and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.
- C. Protect flanges, fittings, and piping specialties from moisture and dirt.
- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate all mechanical equipment installation with other building components, utilities and connections.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
- D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Dielectric Unions:
 - a. Watts Industries, Inc.; Water Products Div.
 - b. Zurn Industries, Inc.; Wilkins Div.
 - 2. Dielectric Flanges:
 - a. Central Plastics Co.
 - b. Watts Industries, Inc.; Water Products Div.
 - 3. Dielectric-Flange Insulating Kits;
 - a. Calpico, Inc.
 - b. Central Plastics Co.
 - 4. Dielectric Couplings:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
 - 5. Metal, Flexible Connectors:
 - a. Grinnell Corp.; Grinnell Supply Sales Co.
 - b. Uniflex, Inc.
 - 6. Rubber, Flexible Connectors:
 - a. Metraflex Co.
 - b. Uniflex, Inc.
 - 7. Mechanical Sleeve Seals:
 - a. Metraflex Co.
 - b. Thunderline/Link-Seal.

2.2 PIPE AND PIPE FITTINGS

- A. Refer to individual Division 15 piping Sections for pipe and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness, unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32.
 - 1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.
- F. Brazing Filler Metals: AWS A5.8.
 - 1. BCuP Series: Copper-phosphorus alloys.
 - 2. BAgl: Silver alloy.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements: Manufacturer's standard solvent cements for the following:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.
- I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.
- K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
 - 1. Sleeve: ASTM A 126, Class B, gray iron.
 - 2. Followers: ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 536 ductile iron.
 - 3. Gaskets: Rubber.
 - 4. Bolts and Nuts: AWWA C111.
 - 5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.5 FLEXIBLE CONNECTORS

- A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig (860-kPa) minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:
 - 1. 2-Inch NPS (DN50) and Smaller: Threaded.
 - 2. 2-1/2-Inch NPS (DN65) and Larger: Flanged.
 - 3. Option for 2-1/2-Inch NPS (DN65) and Larger: Grooved for use with keyed couplings.
- B. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.7 PIPING SPECIALTIES

- A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
 - 1. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
 - 2. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
 - 3. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - a. Underdeck Clamp: Clamping ring with set screws.
- B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
 - 1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
 - 2. OD: Completely cover opening.
 - 3. Cast Brass: One piece, with set screw.
 - a. Finish: Polished chrome-plate.
 - 4. Cast Brass: Split casting, with concealed hinge and set screw.
 - a. Finish: Polished chrome-plate.
 - 5. Cast-Iron Floor Plate: One-piece casting.

2.8 IDENTIFYING DEVICES AND LABELS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 15 Sections. If more than one type is specified for application, selection is Installer's option, but provide one selection for each product category.
- B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.

- C. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap on, color-coded, complying with ASME A13.1.
- D. Plastic Duct Markers: Manufacturer's standard color-coded, laminated plastic. Comply with the following color code:
 - 1. Green: Cold air.
 - 2. Yellow: Hot air.
 - 3. Yellow/Green or Green: Supply air.
 - 4. Blue: Exhaust, outside, return, and mixed air.
 - 5. For hazardous exhausts, use colors and designs recommended by ASME A13.1.
 - 6. Nomenclature: Include the following:
 - a. Direction of airflow.
 - b. Duct service.
 - c. Duct origin.
 - d. Duct destination.
- E. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated.
 - 1. Fabricate in sizes required for message.
 - 2. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
 - 3. Punch for mechanical fastening.

2.9 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psig (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 15 piping Sections specify unique piping installation requirements.
- B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.
- C. Install piping at indicated slope.
- D. Install components with pressure rating equal to or greater than system operating pressure.

- E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- F. Install piping free of sags and bends.
- G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- I. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.
- J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- K. Install fittings for changes in direction and branch connections.
- L. Install couplings according to manufacturer's written instructions.
- M. Sleeves are not required for core drilled holes.
- N. Permanent sleeves are not required for holes formed by PE removable sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
- P. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions.
- Q. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Section "Firestopping" for materials.
- S. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
 - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - 3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
 - 4. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 5. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.

6. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
 7. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - b. ABS Piping: ASTM D 2235 and ASTM D 2661.
 - c. CPVC Piping: ASTM D 2846 and ASTM F 493.
 - d. PVC Pressure Piping: ASTM D 2672.
 - e. PVC Nonpressure Piping: ASTM D 2855.
 8. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.
 - a. Plain-End Pipe and Fittings: Use butt fusion.
 - b. Plain-End Pipe and Socket Fittings: Use socket fusion.
- T. Piping Connections: Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
 2. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
- B. Install equipment according to approved submittal data and manufacturers instructions. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

3.3 LABELING AND IDENTIFYING

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow..
 1. Plastic markers, with application systems. Install on insulation segment if required for hot, uninsulated piping.

2. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior nonconcealed locations:
 - a. Near each valve and control device.
 - b. Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
 - c. Near locations if pipes pass through walls, floors, ceilings, or enter nonaccessible enclosures.
 - d. At access doors, manholes, and similar access points that permit view of concealed piping.
 - e. Spaced at maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment.
- B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of mechanical equipment.
 1. Lettering Size: Minimum 1/4-inch- (6.4-mm-) high lettering for name of unit if viewing distance is less than 24 inches (610 mm), 1/2-inch- (12.7-mm-) high lettering for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
- C. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows, showing duct system service and direction of flow.

3.4 PAINTING AND FINISHING

- A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.
- B. Apply paint to exposed piping according to the following, unless otherwise indicated:
 1. Interior: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
 2. Exterior: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.
- C. Do not paint piping specialties with factory-applied finish.
- D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

- B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.8 DEMOLITION

- A. Disconnect, demolish, and remove Work specified in Division 15 Sections.
- B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
- D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches (50 mm) beyond face of adjacent construction. Cap and patch surface to match existing finish.
- E. Removal: Remove indicated equipment from Project site.
- F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.9 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair cut surfaces to match adjacent surfaces.

3.10 GROUTING

- A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix and apply grout according to manufacturer's written instructions.

END OF SECTION 15050

SECTION 15060 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes hangers and supports for mechanical system piping and equipment.
- B. Related Sections include the following:
 - 1. Division 5 Section "Metal Fabrications" for materials for attaching hangers and supports to building structure.
 - 2. Division 13 Sections on fire-suppression piping for fire-suppression pipe hangers.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- C. Design seismic restraint hangers and supports for piping and equipment.
- D. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

1.6 QUALITY ASSURANCE

- A. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pipe Hangers:
 - a. AAA Technology and Specialties Co., Inc.
 - b. B-Line Systems, Inc.
 - 2. Channel Support Systems:
 - a. B-Line Systems, Inc.
 - b. Unistrut Corp.
 - 3. Thermal-Hanger Shield Inserts:
 - a. Carpenter & Patterson, Inc.
 - b. Value Engineered Products, Inc.
 - 4. Powder-Actuated Fastener Systems:
 - a. Gunnebo Fastening Corp.
 - b. Hilti, Inc.

2.2 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
 - 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
 - 1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.
 - 1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
 - 2. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
 - 3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
 - 4. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.

2.3 MISCELLANEOUS MATERIALS

- A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
 - 2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN15 to DN600), if little or no insulation is required.
 - 3. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN15 to DN100), to allow off-center closure for hanger installation before pipe erection.
 - 4. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN20 to DN200).
 - 5. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30 (DN15 to DN750).
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast-iron floor flange.
 - 7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN25 to DN750), from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 8. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN65 to DN500), from single rod if horizontal movement caused by expansion and contraction might occur.
 - 9. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN50 to DN750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500).
- E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
 2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
- F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
 3. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.
- G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
- H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments per manufacturer's requirements to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
1. Field assemble and install according to manufacturer's written instructions.
- C. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- D. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- E. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- F. Insulated Piping: Comply with the following:
- a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

- b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
- c. Do not exceed pipe stress limits according to ASME B31.9.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

3.5 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION 15081 - DUCT INSULATION

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 semirigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
 - 2. Division 15 Section "Pipe Insulation" for insulation for piping systems.

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. 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.
- C. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate clearance requirements with duct Installer for insulation application.

1.7 SCHEDULING

- A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.
 - 2. Flexible Elastomeric Thermal Insulation:
 - a. Armstrong World Industries, Inc.
 - b. Rubatex Corp.

2.2 INSULATION MATERIALS

- A. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- B. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- C. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
 - 1. Adhesive: As recommended by insulation material manufacturer.
 - 2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
- C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.
 - 1. Adhesive: As recommended by insulation material manufacturer.
 - 2. PVC Jacket Color: White or gray.
- D. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with ASTM B 209 (ASTM B 209M), and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness and corrugation dimensions are scheduled at the end of this Section.
 - 1. Finish: Smooth finish.
 - 2. Moisture Barrier: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
- E. Stainless-Steel Jacket: Deep corrugated sheets of stainless steel complying with ASTM A 666, Type 304 or 316; 0.10 inch (2.5 mm) thick; and roll stock ready for shop or field cutting and forming to indicated sizes.
 - 1. Moisture Barrier: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
 - 2. Jacket Bands: Stainless steel, Type 304, 3/4 inch (19 mm) wide.

2.4 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).
 - 1. Tape Width: 4 inches (100 mm).
- B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:
 - 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
- C. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.
 - 1. Welded Pin Holding Capacity: 100 lb (45 kg) for direct pull perpendicular to the attached surface.
- D. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
 - 1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb (45 kg) for direct pull perpendicular to the adhered surface.
- E. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.
- B. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- C. Keep insulation materials dry during application and finishing.
- D. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- E. Apply insulation with the least number of joints practical.
- F. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- G. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
- H. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- I. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
 - 3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- J. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

- K. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.
 - 1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
 - 2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.
- L. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
 - 1. Seal penetrations with vapor-retarder mastic.
 - 2. Apply insulation for exterior applications tightly joined to interior insulation ends.
 - 3. Seal insulation to roof flashing with vapor-retarder mastic.
- M. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- N. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.
- O. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.
 - 1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers and install per manufacturers recommendations.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
 - b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

- A. Apply insulation to ducts and plenums as follows:
 - 1. Follow the manufacturer's written instructions for applying insulation.
 - 2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the duct and plenum surface.

3. On exposed applications, without metal jacket, finish insulation with a skim coat of mineral-fiber, hydraulic-setting cement to surface of installed insulation. When dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin the finish coat to achieve smooth finish.

3.6 FIELD-APPLIED JACKET APPLICATION

- A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.
 1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
 3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.7 FINISHES

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section "Painting."
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.8 DUCT SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

3.9 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

- A. Service: supply-air ducts, concealed.
 1. Material: **Mineral-fiber blanket**
 2. Thickness: **2 inches (50 mm)**
 3. Number of Layers: **One**
 4. Field-Applied Jacket **Foil and paper**
- B. Service: return-air ducts, concealed.
 1. Material **Mineral-fiber blanket**
 2. Thickness: **2 inches (50 mm)**
 3. Number of Layers: **One**
 4. Field-Applied Jacket: **Foil and paper**

3.10 OUTDOOR DUCT AND PLENUM APPLICATION SCHEDULE

- A. Service: supply and return-air ducts.

1. Material: **Mineral-fiber blanket.**
2. Thickness **2 inches**
3. Number of Layers: **One**
4. Field-Applied Jacket: Aluminum.
 - a. Aluminum Thickness: **0.032 inch (0.8 mm)**
5. Vapor Retarder Required: **Yes**

3.11 BOILER BREECHING AND CONNECTOR APPLICATION SCHEDULE

A. Service:

1. Material: **Mineral-fiber board**
2. Thickness: **1-1/2 inches (38 mm)**
3. Number of Layers: **One**
4. Field-Applied Jacket: Aluminum.
 - a. Aluminum Thickness: **0.032 inch (0.8 mm)**

END OF SECTION 15081

SECTION 15083 - PIPE INSULATION

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 preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
 - 2. Division 15 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show product literature and installation details. for the following:
- C. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for insulation application.
- C. Coordinate installation and testing of steam or electric heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.
 - 2. Cellular-Glass Insulation:
 - a. Pittsburgh-Corning Corp.

2.2 INSULATION MATERIALS

- A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
 - 1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
 - 2. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
 - a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
 - b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
 - 3. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
 - 4. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
 - 5. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.

6. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- B. Cellular-Glass Insulation: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.
 1. Preformed Pipe Insulation, without Jacket: Comply with ASTM C 552, Type II, Class 1.
 2. Preformed Pipe Insulation, with Jacket: Comply with ASTM C 552, Type II, Class 2.
- C. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
- C. Heavy PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 30-mil- (0.75-mm-) thick, high-impact, ultraviolet-resistant PVC.
 1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
 2. Adhesive: As recommended by insulation material manufacturer.
- D. Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209 (ASTM B 209M), 3003 alloy, H-14 temper.

2.4 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).
 1. Tape Width: 4 inches (100 mm).
- B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:
- C. Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Install insulation on all hot water piping and on domestic water piping run in exterior walls or plenums subject to freezing. Insulate all storm water piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- C. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- D. Apply multiple layers of insulation with longitudinal and end seams staggered.
- E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- F. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- G. Keep insulation materials dry during application and finishing.
- H. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- I. Apply insulation with the least number of joints practical.
- J. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.
- K. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
 - 1. Apply insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- L. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

- M. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- N. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
 - 3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
- O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
 - 1. Seal penetrations with vapor-retarder mastic.
 - 2. Apply insulation for exterior applications tightly joined to interior insulation ends.
 - 3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
 - 4. Seal metal jacket to roof flashing with vapor-retarder mastic.
- P. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.
- Q. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.
- R. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."
- S. Floor Penetrations: Apply insulation continuously through floor assembly.
 - 1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
 - 2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
 - 3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
 - 4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.
- B. Apply insulation to flanges as follows:
 - 1. Apply preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.
4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.5 CELLULAR-GLASS INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of the same thickness as pipe insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded sections of insulation are not available, apply mitered sections of cellular-glass insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.
4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded segments of cellular-glass insulation or glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
2. Apply insulation to flanges as specified for flange insulation application.
3. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
4. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.6 PIPING SYSTEM APPLICATIONS

A. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Vibration-control devices.
3. Fire-suppression piping.
4. Chrome-plated pipes and fittings, unless potential for personnel injury.
5. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.7 FIELD QUALITY CONTROL

A. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:

1. Inspect fittings and valves randomly selected by Architect.
2. Remove fitting covers from 20 elbows or 1 percent of elbows, whichever is less, for various pipe sizes.

B. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.

- C. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

3.8 INSULATION APPLICATION SCHEDULE, GENERAL

- A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.
- B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.9 INTERIOR INSULATION APPLICATION SCHEDULE

- A. Service: Domestic hot and recirculated hot water.
 - 1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
- B. Service: Rainwater conductors.
 - 1. Operating Temperature: 32 to 100 deg F (0 to 38 deg C).
- C. Service: Roof drain bodies.
 - 1. Operating Temperature: 32 to 100 deg F (0 to 38 deg C).
- D. Service: Exposed sanitary drains and domestic water supplies and stops for fixtures for the disabled.
 - 1. Operating Temperature: 35 to 120 deg F (2 to 49 deg C).

3.10 EXTERIOR INSULATION APPLICATION SCHEDULE

- A. This application schedule is for aboveground insulation outside the building. Loose-fill insulation, for belowground piping, is specified in Division 2 piping distribution Sections.
- B. Service: Domestic water.
 - 1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
 - 2. Insulation Material: **Cellular glass, with jacket** Insulation Thickness: Apply the following insulation thicknesses: 1"
 - 3. Field-Applied Jacket: **Aluminum**
 - 4. Vapor Retarder Required: **Yes**

END OF SECTION 15083

SECTION 15150 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.
- B. Related Sections include the following:
 - 1. Division 15 Section "Plumbing Specialties" for soil, waste, and vent piping systems specialties.

1.3 DEFINITIONS

- A. The following are industry abbreviations for piping materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: **10-foot head of water**

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings: For sovent drainage system, include plans, elevations, sections, and details.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

- C. PVC or similar piping in return air plenum and concealed spaces will not be permitted to be installed where not approved by local plumbing code and authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.
- C. Transition Couplings for Underground Pressure Piping: AWWA C219 metal, sleeve-type coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 CAST-IRON SOIL PIPING

- A. Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Pipe and Fittings: ASTM A 888 or CISPI 301.
 - 1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.
 - 2. Sovent Fittings: ASME B16.45 or ASSE 1043, hubless, aerator and deaerator.

2.3 COPPER TUBING

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

2.4 ABS PIPING

- A. ABS Pipe: ASTM D 2661, Schedule 40, solid wall.
 - 1. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
- B. ABS Special Fittings: ASTM F 409, drainage-pattern tube and tubular fittings with ends as required for application.

2.5 PVC PIPING

- A. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
- B. PVC Special Fittings: ASTM F 409, drainage-pattern tube and tubular fittings with ends as required for application.
- C. Where installed in open ceiling plenums or chases used for return air, PVC piping and components shall be wrapped in fire proof blanket insulation.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.
- C. Soil, Waste, and Vent Piping: Use any of the following piping materials for each size range:
 1. Solvent Fittings: NPS 3 to NPS 8 .
 2. NPS 1-1/4 and NPS 4: Use NPS 1-1/2 hubless, cast-iron soil piping and the following:
 - a. Couplings: Heavy-duty, Type 301, stainless steel.
 3. NPS 1-1/4 and NPS 4: Copper DWV tube, copper drainage fittings, and soldered joints.
 4. NPS 1-1/4 and NPS 4: ABS pipe, ABS socket fittings, and solvent-cemented joints.
 5. NPS 5 and NPS 6 : Service class, cast-iron soil piping; gaskets; and gasketed joints.
 6. NPS 5 and NPS 6 : Hubless, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 301, stainless steel.
 7. NPS 5 and NPS 6 Steel pipe; cast-iron, threaded drainage fittings; and threaded joints.
 8. NPS 5 and NPS 6: Use NPS 6 PVC pipe, PVC socket fittings, and solvent-cemented joints.
 9. NPS 8 : Service class, cast-iron soil piping; gaskets; and gasketed joints.
 10. NPS 8 : Sch. 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.3 PIPING INSTALLATION

- A. Refer to Division 2 Section "Sanitary Sewerage" for Project-site sanitary sewer piping.
- B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

- E. Underground, Ductile-Iron, Force-Main Piping: Comply with AWWA C600. Install buried piping inside the building between wall and floor penetrations and connection to sanitary sewer piping outside the building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
 - 1. Encase piping with PE film according to ASTM A 674 or AWWA C105.
- F. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.
- G. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for wall penetration systems.
- H. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Encase underground piping with PE film according to ASTM A 674 or AWWA C105.
- I. Make changes in direction for soil and waste 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 2 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.
- J. 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.
- K. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- L. Install force mains at elevations indicated.
- M. Install engineered soil and waste drainage and vent piping systems in locations indicated and as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - 2. Cast-Iron, Solvent, Single Stack: Comply with ASSE 1043 and solvent fitting manufacturer's written installation instructions.
 - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- N. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- O. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.

- P. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- Q. Install underground ABS and PVC soil and waste drainage piping according to ASTM D 2321.
- R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- S. Install metallic caution tape 12" below finish grade in sewer trench.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- D. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- E. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 VALVE INSTALLATION

- A. Refer to Division 15 Section "Valves" for general-duty valves.
- B. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.
- C. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet : MSS Type 43, adjustable roller hangers.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.

- B. Install supports according to Division 15 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install supports for vertical cast-iron soil piping every 15 feet .
- F. Install supports for vertical ABS and PVC piping every 48 inches.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Specialties."
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Connect force-main piping to the following:
 - 1. Sanitary Sewer: To exterior force main or sanitary manhole.
 - 2. Sewage Pumps: To sewage pump discharge.

3.8 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. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary 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.
 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.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for twentyfour hours. Leaks and loss in test pressure constitute defects that must be repaired.
 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 4. Prepare reports for tests and required corrective action.

3.9 CLEANING

- 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.

3.10 PROTECTION

- A. Exposed **ABS and PVC** Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 15150

SECTION 15815 - METAL DUCTS

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 rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 2-inch wg
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants" for fire-resistant sealants for use around duct penetrations and fire-damper installations in fire-rated floors, partitions, and walls.
 - 2. Division 8 Section "Access Doors" for wall- and ceiling-mounted access doors for access to concealed ducts.
 - 3. Division 10 Section "Louvers and Vents" for intake and relief louvers and vents connected to ducts and installed in exterior walls.
 - 4. Division 15 Section "Mechanical Insulation" for duct insulation.
 - 5. Division 15 Section "Duct Accessories" for dampers, sound-control devices, duct-mounted access doors and panels, turning vanes, and flexible ducts.
 - 6. Division 15 Section "Testing, Adjusting, and Balancing" for air balancing and final adjusting of manual-volume dampers.

1.3 DEFINITIONS

- A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula $\text{Btu} \times \text{in./h} \times \text{sq. ft.} \times \text{deg F}$ or $\text{W/m} \times \text{K}$ at the temperature differences specified. Values are expressed as Btu or W.
 - 1. Example: Apparent Thermal Conductivity (k-Value): 0.26 or 0.037.

1.4 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

- A. Product Data: For duct liner and sealing materials.

- B. Welding Certificates: Copies of certificates indicating welding procedures and personnel comply with requirements in "Quality Assurance" Article.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- D. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

1.6 QUALITY ASSURANCE

- A. Welding Standards: Qualify welding procedures and welding personnel to perform welding processes for this Project according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports; AWS D1.2, "Structural Welding Code--Aluminum," for aluminum supporting members; and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.
- C. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Chapter 3, "Duct System," for range hood ducts, unless otherwise indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle sealant and firestopping materials according to manufacturer's written recommendations.
- C. Deliver and store stainless-steel sheets with mill-applied adhesive protective paper maintained through fabrication and installation.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. .
- C. Stainless Steel: ASTM A 480/A 480M, Type 316, sheet form with No. 4 finish for surfaces of ducts exposed to view; and Type 304, sheet form with No. 1 finish for concealed ducts.
- D. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches

2.2 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
1. Joint and Seam Tape: 2 inches wide; glass-fiber fabric reinforced.
 2. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.
 3. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
 4. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

2.3 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for building materials.
1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- B. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.
1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
 2. Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
1. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.
 2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
 3. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

2.4 RECTANGULAR DUCT FABRICATION

- A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
 2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

- B. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:
 - 1. Supply Ducts: 2-inch wg
 - 2. Return Ducts: 1-inch wg , negative pressure.
 - 3. Exhaust Ducts: 2-inch wg , negative pressure.
- C. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of unbraced panel area, unless ducts are lined.

2.5 ROUND AND FLAT-OVAL DUCT FABRICATION

- A. Round Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Double-Wall (Insulated) Ducts: Fabricate double-wall (insulated) ducts with an outer shell and an inner liner. Dimensions indicated on internally insulated ducts are inside dimensions.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

- A. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.
- B. Construct and install each duct system for the specific duct pressure classification indicated.
- C. Install round and flat-oval ducts in lengths not less than 12 feet , unless interrupted by fittings.
- D. Install ducts with fewest possible joints.
- E. Install fabricated fittings for changes in directions, changes in size and shape, and connections.
- F. Install couplings tight to duct wall surface with a minimum of projections into duct.
- G. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 2 inch , plus allowance for insulation thickness.
- J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
- K. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- L. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches (38 mm).
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, and firestopping sealant. Fire and smoke dampers are specified in Division 15 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Firestopping."

3.2 SEAM AND JOINT SEALING

- A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Pressure Classification Less Than 2-Inch wg Transverse joints.
- C. Seal externally insulated ducts before insulation installation.

3.3 HANGING AND SUPPORTING

- A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Support vertical ducts at a maximum interval of 16 feet and at each floor.
- D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- E. Install concrete inserts before placing concrete.
- F. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3.4 CONNECTIONS

- A. Connect equipment with flexible connectors according to Division 15 Section "Duct Accessories."
- B. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

3.5 FIELD QUALITY CONTROL

- A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.
- B. Conduct tests, in presence of Architect, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

- C. Determine leakage from entire system or section of system by relating leakage to surface area of test section.
- D. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round and flat-oval ducts, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (both positive and negative pressures).
- E. Remake leaking joints and retest until leakage is less than maximum allowable.
- F. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

3.6 ADJUSTING

- A. Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.
- B. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for detailed procedures.

3.7 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

END OF SECTION 15815

SECTION 15990 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
 - 1. Balancing airflow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
 - 2. Adjusting total HVAC systems to provide indicated quantities.
 - 3. Measuring electrical performance of HVAC equipment.
 - 4. Verifying that automatic control devices are functioning properly.
 - 5. Reporting results of the activities and procedures specified in this Section.
- B. Related Sections include the following:
 - 1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
 - 2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.3 DEFINITIONS

- A. Adjust: To regulate air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- K. Test: A procedure to determine quantitative performance of a system or equipment.
- L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.
- M. AABC: Associated Air Balance Council.
- N. AMCA: Air Movement and Control Association.
- O. CTI: Cooling Tower Institute.
- P. NEBB: National Environmental Balancing Bureau.
- Q. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.4 SUBMITTALS

- A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.
- B. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.
- C. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.
- D. Sample Report Forms: Submit 6 sets of sample testing, adjusting, and balancing report forms.
- E. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

1.5 QUALITY ASSURANCE

- A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by either AABC or NEBB.
- B. Independent Agency not associated with contractor, sub contractor, equipment supplier or controls contractor involved on this project.
- C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.

2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
- D. Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 PROJECT CONDITIONS

- A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.7 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.
- B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.
- C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

- A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. National Project Performance Guarantee: Provide a guarantee on AABC'S "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
 1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
 2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine project record documents described in Division 1 Section "Project Record Documents."
- D. Examine Architect's and Engineer's 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. 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. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.
- L. Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- M. Examine strainers for clean screens and proper perforations.
- N. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- O. Examine equipment for installation and for properly operating safety interlocks and controls.
- P. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

- A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.

2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
6. Windows and doors can be closed so design conditions for system operations can be met.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC or NEBB's national standards and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
- C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
- C. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
 1. Title page.
 2. Name and address of testing, adjusting, and balancing Agent.
 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 testing, adjusting, and balancing Agent who certifies the report.
 10. Summary of contents, including the following:
 - a. Design versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 11. Nomenclature sheets for each item of equipment.
 12. Data for terminal units, including manufacturer, type size, and fittings.
 13. Notes to explain why certain final data in the body of reports vary from design values.
 - a. Test conditions for fans and pump performance forms.

- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.

3.5 ADDITIONAL TESTS

- A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION 15990

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. Raceways.
 - 2. Building wire and connectors.
 - 3. Supporting devices for electrical components.
 - 4. Electrical identification.
 - 5. Electricity-metering components.
 - 6. Concrete equipment bases.
 - 7. Electrical demolition.
 - 8. Cutting and patching for electrical construction.
 - 9. Touchup painting.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
 - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
 - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
 - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 RACEWAYS WHERE APPROVED BY CODE

- A. EMT: ANSI C80.3, zinc-coated steel, with set-screw or compression fittings.
- B. FMC: Zinc-coated steel.
- C. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.
- D. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
- E. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.
- F. Raceway Fittings: Specifically designed for the raceway type with which used.

2.2 CONDUCTORS

- A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.
- B. Conductors, Larger Than No. 10 AWG: Stranded copper.
- C. Insulation: Thermoplastic, rated at 75 deg C minimum.

- D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

2.3 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and ~~9/16-inch-~~ (14-mm-) diameter slotted holes at a maximum of ~~2 inches~~ (50 mm) o.c., in webs.
- D. Slotted-Steel Channel Supports: Comply with Division 5 Section "Metal Fabrications" for slotted channel framing.
 - 1. Channel Thickness: Selected to suit structural loading.
 - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- E. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with ~~9/16-inch-~~ (14-mm-) diameter holes at a maximum of ~~8 inches~~ (203 mm) o.c., in at least one surface.
 - 1. Fittings and Accessories: Products of the same manufacturer as channels and angles.
 - 2. Fittings and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
- F. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- G. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- H. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- I. Expansion Anchors: Carbon-steel wedge or sleeve type.
- J. Toggle Bolts: All-steel springhead type.
- K. Powder-Driven Threaded Studs: Heat-treated steel.

2.4 ELECTRICAL IDENTIFICATION

- A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.
 - 1. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.
 - 2. Color: Black letters on orange background.

3. Legend: Indicates voltage.
 - C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than **1 inch wide by 3 mils thick (25 mm wide by 0.08 mm thick)**.
 - D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
 1. Not less than **6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick)**.
 2. Compounded for permanent direct-burial service.
 3. Embedded continuous metallic strip or core.
 4. Printed legend that indicates type of underground line.
 - E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
 - F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
 - G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners **1/16-inch (1.6-mm)** minimum thickness for signs up to **20 sq. in. (129 sq. cm)** and **1/8-inch (3.2-mm)** minimum thickness for larger sizes. Engraved legend in black letters on white background.
 - H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.
 - I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with **0.0396-inch (1-mm)**, galvanized-steel backing, with colors, legend, and size appropriate to the application. **1/4-inch (6-mm)** grommets in corners for mounting.
 - J. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.
- 2.5 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING
- A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
 - B. Meter Sockets: Comply with requirements of electrical power utility company.
- 2.6 CONCRETE BASES
- A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
 - B. Concrete: **3000-psi (20.7-MPa)**, 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."
- 2.7 TOUCHUP PAINT
- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 RACEWAY APPLICATION

- A. Use the following raceways for outdoor installations:
 - 1. Exposed: IMC.
 - 2. Concealed: IMC.
 - 3. Underground, Single Run: RNC.
 - 4. Underground, Grouped: RNC.
 - 5. Connection to Vibrating Equipment: LFMC.
 - 6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.
- B. Use the following raceways for indoor installations:
 - 1. Exposed: EMT.
 - 2. Concealed: EMT.
 - 3. Connection to Vibrating Equipment: FMC; except in wet or damp locations, use LFMC.
 - 4. Damp or Wet Locations: IMC.
 - 5. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

3.3 RACEWAY AND CABLE INSTALLATION

- A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.
- B. Install raceways and cables at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.
- C. Use temporary raceway caps to prevent foreign matter from entering.
- D. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- E. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.

- F. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least **1-inch (25-mm)** concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Install conduit larger than **1-inch trade size (DN27)** parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
 - 4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
 - 5. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.
- G. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel 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 the pull wire.
- H. Install telephone and signal system raceways, **2-inch trade size (DN53)** and smaller, in maximum lengths of **150 feet (45 m)** and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.
- I. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of **72-inch (1830-mm)** flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.
- J. Set floor boxes level and trim after installation to fit flush to finished floor surface.

3.4 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

- A. Feeders: [**Type THHN/THWN insulated conductors in raceway**] Underground Feeders and Branch Circuits: Type THWN or single-wire, Type UF insulated conductors in raceway.
- B. Branch Circuits: Type THHN/THWN insulated conductors in raceway.
- C. Branch Circuits: Type THW or THHN/THWN insulated conductors in raceway where exposed. Metal-clad cable where concealed in ceilings and gypsum board partitions.
- D. Branch Circuits: Type THW or THHN/THWN insulated conductors in raceway where exposed. Armored or nonmetallic sheathed cable where permitted by authorities having jurisdiction and where concealed in ceilings and gypsum board partitions.
- E. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.5 WIRING INSTALLATION

- A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- B. Install wiring at outlets with at least **12 inches (300 mm)** of slack conductor at each outlet.

- C. Connect outlet and component connections to wiring systems and to ground. 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.

3.6 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.7 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 1. Wood: Fasten with wood screws or screw-type nails.
 - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 - 3. New Concrete: Concrete inserts with machine screws and bolts.
 - 4. Existing Concrete: Expansion bolts.
 - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
 - 6. Steel: Welded threaded studs or spring-tension clamps on steel.
 - a. Field Welding: Comply with AWS D1.1.
 - 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
 - 8. Light Steel: Sheet-metal screws.
 - 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.8 IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Self-Adhesive Identification Products: Clean surfaces before applying.
- D. Identify raceways and cables with color banding as follows:
 - 1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band **2 inches (51 mm)** wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
 - 2. Band Locations: At changes in direction, at penetrations of walls and floors, at **50-foot (15-m)** maximum intervals in straight runs, and at **25-foot (8-m)** maximum intervals in congested areas.
 - 3. Colors: As follows:
 - a. Fire Alarm System: Red.
 - b. Security System: Blue and yellow.
 - c. Telecommunication System: Green and yellow.
- E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
- F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate

6 to 8 inches (150 to 200 mm) below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm), overall, use a single line marker.

- G. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
 - 1. Phase A: Black.
 - 2. Phase B: Red.
 - 3. Phase C: Blue.
 - 4. Neutral: White.
 - 5. Ground: Green.
- H. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
 - 1. Phase A: Yellow.
 - 2. Phase B: Brown.
 - 3. Phase C: Orange.
 - 4. Neutral: White with a colored stripe or gray.
 - 5. Ground: Green.
- I. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
- J. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.9 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

- A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.10 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."

3.11 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.12 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, **2 inches (50 mm)** below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove demolished material from Project site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.13 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.14 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
 - 1. Raceways.
 - 2. Building wire and connectors.
 - 3. Supporting devices for electrical components.
 - 4. Electrical identification.
 - 5. Electricity-metering components.
 - 6. Concrete bases.
 - 7. Electrical demolition.
 - 8. Cutting and patching for electrical construction.
 - 9. Touchup painting.

3.15 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.16 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 16050

SECTION 16060 - GROUNDING AND BONDING

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 grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
- B. Related Sections include the following:
 - 1. Division 2 Section "Underground Ducts and Utility Structures" for ground test wells.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Data: For the following:
 - 1. Ground rods.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Field Test Reports: Submit written test reports to include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 1. Comply with UL 467.
- C. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grounding Conductors, Cables, Connectors, and Rods:
 - a. Ideal Industries, Inc.
 - b. Lightning Master Corp.
 - c. Superior Grounding Systems, Inc.
 - d. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."
- B. Material, and copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- G. Bare Copper Conductors: Comply with the following:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Assembly of Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
- H. Copper Bonding Conductors: As follows:
 - 1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
 - 2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
 - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
 - 4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

2.3 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: [**Copper-clad**] steel.
- B. Ground Rods: Sectional type; [**copper-clad**] steel.
 - 1. Size: [**3/4 by 120 inches (19 by 3000 mm)**] [in diameter.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.
- F. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Use insulated spacer; space **1 inch (25.4 mm)** from wall and support from wall **6 inches (150 mm)** above finished floor, unless otherwise indicated.
 - 2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.
- G. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least **24 inches (600 mm)** below grade or bury **12 inches (300 mm)** above duct bank when installed as part of the duct bank.

3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:

1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
- D. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- E. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- F. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- G. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- H. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- I. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- J. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- K. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6.4-by-50-by-300-mm) grounding bus.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- L. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.
- M. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

3.3 INSTALLATION

- A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
 - 1. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
 - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- E. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, Paragraph 250-81(c), using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.4 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - 4. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
 - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
 - 3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
 - a. Equipment Rated 500 kVA and Less: 10 ohms.
 - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
 - c. Equipment Rated More Than 1000 kVA: 3 ohms.
 - d. Substations and Pad-Mounted Switching Equipment: 5 ohms.
 - 4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.6 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

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END OF SECTION 16060

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

- 1. Raceways include the following: where approved by code.

- a. RMC.
 - b. IMC.
 - c. PVC externally coated, rigid steel conduits.
 - d. PVC externally coated, IMC.
 - e. EMT.
 - f. FMC.
 - g. LFMC.
 - h. LFNC.
 - i. RNC.
 - j. ENT.
 - k. Wireways.
 - l. Surface raceways.

- 2. Boxes, enclosures, and cabinets include the following:

- a. Device boxes.
 - b. Floor boxes.
 - c. Outlet boxes.
 - d. Pull and junction boxes.
 - e. Cabinets and hinged-cover enclosures.

- B. Related Sections include the following:

- 1. Division 7 Section "Firestopping."
 - 2. Division 16 Section "Basic Electrical Materials and Methods" for raceways and box supports.
 - 3. Division 16 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.

- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RMC: Rigid metal conduit.
- H. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 QUALITY ASSURANCE

- A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NECA's "Standard of Installation."
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Metal Conduit and Tubing:
 - a. Carol Cable Co., Inc.
 - b. Grinnell Co.; Allied Tube and Conduit Div.
 - c. Monogram Co.; AFC.
 - d. Triangle PWC, Inc.
 - e. Wheatland Tube Co.
 - 2. Nonmetallic Conduit and Tubing:

- a. Anamet, Inc.; Anaconda Metal Hose.
 - b. Certainteed Corp.; Pipe & Plastics Group.
 - c. Electri-Flex Co.
 - d. George-Ingraham Corp.
 - e. Hubbell, Inc.; Raco, Inc.
 - f. Thomas & Betts Corp.
3. Conduit Bodies and Fittings:
- a. Emerson Electric Co.; Appleton Electric Co.
 - b. Hubbell, Inc.; Killark Electric Manufacturing Co.
 - c. O-Z/Gedney; Unit of General Signal.
 - d. Spring City Electrical Manufacturing Co.
4. Metal Wireways:
- a. Hoffman Engineering Co.
 - b. Keystone/Rees, Inc.
 - c. Square D Co.
5. Nonmetallic Wireways:
- a. Hoffman Engineering Co.
 - b. Lamson & Sessions; Carlon Electrical Products.
6. Surface Metal Raceways:
- a. American Electric; Construction Materials Group.
 - b. Butler Manufacturing Co.; Walker Division.
 - c. Wiremold Co. (The); Electrical Sales Division.
7. Surface Nonmetallic Raceways:
- a. Hubbell, Inc.; Wiring Device Division.
 - b. Panduit Corp.
 - c. United Telecom; Premier Telecom Products, Inc.
 - d. Wiremold Co. (The); Electrical Sales Division.
8. Boxes, Enclosures, and Cabinets:
- a. Hubbell Inc.; Raco, Inc.
 - b. O-Z/Gedney; Unit of General Signal.
 - c. Thomas & Betts Corp.

2.2 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Rigid Aluminum Conduit: ANSI C80.5.
- C. IMC: ANSI C80.6.
- D. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.
- E. Plastic-Coated IMC and Fittings: NEMA RN 1.
- F. EMT and Fittings: ANSI C80.3.

1. Fittings: Set-screw or compression type.
2. Fittings: Set-screw type.
3. Fittings: Compression type.

- G. FMC: Aluminum.
- H. FMC: Zinc-coated steel.
- I. LFMC: Flexible steel conduit with PVC jacket.
- J. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

- A. ENT: NEMA TC 13.
- B. RNC: NEMA TC 2, Schedule 40 or 80 PVC.
- C. ENT and RNC Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.
- D. LFNC: UL 1660.

2.4 METAL WIREWAYS

- A. Material: Sheet metal sized and shaped as indicated.
- B. Fittings and Accessories: Include 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.
- C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- D. Wireway Covers: As indicated
- E. Wireway Covers: Flanged-and-gasketed type.
- F. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

- A. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captivated screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
- B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections using plastic fasteners.
- C. Fittings and Accessories: Include 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. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.6 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.
- B. Surface Nonmetallic Raceways: 2-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.
- C. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.7 OUTLET AND DEVICE BOXES

- A. Sheet Metal Boxes: NEMA OS 1.
- B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.
- C. Nonmetallic Boxes: NEMA OS 2.

2.8 FLOOR BOXES

- A. Floor Boxes: Cast metal, fully adjustable, rectangular.

2.9 PULL AND JUNCTION BOXES

- A. Small Sheet Metal Boxes: NEMA OS 1.
- B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.10 ENCLOSURES AND CABINETS

- A. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

- A. Outdoors: Use the following wiring methods:
 - 1. Exposed: Rigid steel or IMC.
 - 2. Concealed: Rigid steel or IMC.
 - 3. Underground, Single Run: RNC.
 - 4. Underground, Grouped: RNC.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.
- B. Indoors: Use the following wiring methods:
 - 1. Exposed: EMT or RNC.
 - 2. Concealed: EMT, ENT, or RNC.
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
 - 4. Damp or Wet Locations: Rigid steel conduit.
 - 5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 4, nonmetallic.

3.3 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Minimum Raceway Size: 1/2-inch trade size (DN16).
- C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.
- D. 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.
- E. Install raceways level and square and at proper elevations. Provide adequate headroom.
- F. Complete raceway installation before starting conductor installation.
- G. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."
- H. Use temporary closures to prevent foreign matter from entering raceways.
- I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

- K. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.
- L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
- M. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
- N. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
 - 1. Run parallel or banked raceways together, on common supports where practical.
 - 2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- O. Join raceways with fittings designed and approved for the purpose and make joints tight.
 - 1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
 - 2. Use insulating bushings to protect conductors.
- P. Tighten set screws of threadless fittings with suitable tools.
- Q. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.
- R. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
- S. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel 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 the pull wire.
- T. Telephone and Signal System Raceways, 2-Inch Trade Size (DN53) and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- U. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.

2. Where otherwise required by NFPA 70.
 - V. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.
 - W. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.
 - X. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in a nonmetallic sleeve.
 - Y. Do not install aluminum conduits embedded in or in contact with concrete.
 - Z. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.
 - AA. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.
 1. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy.
 2. Where a surface raceway is used to supply a fluorescent lighting fixture having central-stem suspension with a backplate and a canopy (with or without extension ring), no separate outlet box is required.
 3. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end-stem suspension.
 4. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed, no additional surface-mounted outlet box is required. Provide a backplate slightly smaller than the fixture canopy.
 - BB. Set floor boxes level and adjust to finished floor surface.
 - CC. Set floor boxes level and trim after installation to fit flush to finished floor surface.
- 3.4 PROTECTION
- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.
- 3.5 CLEANING
- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

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END OF SECTION 16130

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.

1.4 SUBMITTALS

- A. Product Data: For each product specified.
- B. Shop Drawings: Legends for receptacles and switch plates.
- C. Samples: For devices and device plates for color selection and evaluation of technical features.
- D. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NEMA WD 1.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wiring Devices:
 - a. Bryant Electric, Inc.
 - b. Eagle Electric Manufacturing Co., Inc.
 - c. GE Company; GE Wiring Devices.
 - d. Hubbell, Inc.; Wiring Devices Div.
 - e. Killark Electric Manufacturing Co.
 - f. Leviton Manufacturing Co., Inc.
 - g. Pass & Seymour/Legrand; Wiring Devices Div.
 - h. Pyle-National, Inc.; an Amphenol Co.
 - 2. Multioutlet Assemblies:
 - a. Airey-Thompson Co.
 - b. Wiremold.
 - 3. Poke-through, Floor Service Outlets and Telephone/Power Poles:
 - a. American Electric.
 - b. Hubbell, Inc.; Wiring Devices Div.
 - c. Pass & Seymour/Legrand; Wiring Devices Div.
 - d. Square D Co.
 - e. Wiremold.

2.2 RECEPTACLES

- A. Straight-Blade and Locking Receptacles: General-Duty grade.
- B. GFCI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter.
- C. Isolated-Ground Receptacles: Equipment grounding contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from mounting strap.
 - 1. Devices: Listed and labeled as isolated-ground receptacles.
 - 2. Isolation Method: Integral to receptacle construction and not dependent on removable parts.

2.3 PENDANT CORD/CONNECTOR DEVICES

- A. Description: Matching, locking type, plug and receptacle body connector, NEMA WD 6, Configurations L5-20P and L5-20R, Heavy-Duty grade.
 - 1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
 - 2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.4 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A jacket. Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.5 SWITCHES

- A. Snap Switches: General-duty, quiet type.

2.6 WALL PLATES

- A. Single and combination types match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.

2.7 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartmentation: Barrier separates power and signal compartments.
- C. Housing Material: Die-cast aluminum, satin finished.
- D. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Signal Outlet: Blank cover with bushed cable opening, unless otherwise indicated.

2.8 MULTIOUTLET ASSEMBLIES

- A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- B. Raceway Material: Metal, with manufacturer's standard finish.
- C. Wire: No. 12 AWG.

2.9 TELEPHONE/POWER SERVICE POLES

- A. Description: Factory-assembled and -wired units to extend power, telephone, and data service from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
 - 1. Poles: Nominal 2.5-inch- (65-mm-) square cross section with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and separate channels for power and signal wiring.

2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports, and pole foot with carpet pad attachment.
3. Finishes: One of manufacturers standard finish and trim combinations, including painted and satin anodized-aluminum finishes and wood-grain-type trim.
4. Wiring: Sized for three No. 12 AWG power and ground conductors; one 75-ohm coaxial telephone/data cable; and one four-pair, 75-ohm telephone/data cable.
5. Power Receptacles: Two single; 20-A; heavy-duty; NEMA WD 6, Configuration 5-20R units.
6. Signal Outlets: Blank insert with bushed cable opening.

2.10 FINISHES

- A. Color: White, unless otherwise indicated or required by Code.
- B. Color: Manufacturers standard, as selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. Do not share neutral conductor on load side of dimmers.
- D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- E. Protect devices and assemblies during painting.
- F. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 16 Section "Electrical Identification."
- B. Comply with Division 16 Section "Basic Electrical Materials and Methods."

3.3 CONNECTIONS

- A. Connect wiring device grounding terminal to outlet box with bonding jumper.
- B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- C. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.
- D. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.
- B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- C. Replace damaged or defective components.

3.5 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 16140

SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:
 - 1. Service disconnecting means.
 - 2. Feeder and branch-circuit protection.
 - 3. Motor and equipment disconnecting means.
- B. Related Sections include the following:
 - 1. Division 16 Section "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.
 - 2. Division 16 Section "Switchboards" for individually enclosed, fusible switches used as feeder protection.
 - 3. Division 16 Section "Fuses" for fusible devices.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. RMS: Root mean square.
- C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
- C. Field Test Reports: Submit written test reports and include the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

- D. Manufacturer's field service report.
- E. Maintenance Data: For enclosed switches and circuit breakers and for components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Closeout Procedures," include the following:
 - 1. Routine maintenance requirements for components.
 - 2. Manufacturer's written instructions for testing and adjusting switches and circuit breakers.
 - 3. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA AB 1 and NEMA KS 1.
- C. Comply with NFPA 70.
- D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
 - 2. Altitude: Not exceeding 6600 feet (2000 m).

1.7 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Fusible Switches:
 - a. General Electric Co.; Electrical Distribution & Control Division.

- b. Square D Co.
- 2. Molded-Case Circuit Breakers:
 - a. General Electric Co.; Electrical Distribution & Control Division.
 - b. Square D Co.
- 3. Combination Circuit Breaker and Ground-Fault Trip:
 - a. General Electric Co.; Electrical Distribution & Control Division.
 - b. Square D Co.
- 4. Molded-Case, Current-Limiting Circuit Breakers:
 - a. General Electric Co.; Electrical Distribution & Control Division.
 - b. Square D Co.
- 5. Integrally Fused, Molded-Case Circuit Breakers:
 - a. General Electric Co.; Electrical Distribution & Control Division.
 - b. Square D Co.

2.2 ENCLOSED SWITCHES

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type **[GD]** with lockable handle.
- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handle with two padlocks, and interlocked with cover in closed position.

2.3 ENCLOSED CIRCUIT BREAKERS

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 3. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
 - 4. GFCI Circuit Breakers: Single- and two-pole configurations with **[] [30]-mA** trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs **[Compression]** style suitable for number, size, trip ratings, and material of conductors.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Ground-Fault Protection: **[Integrally mounted]** relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - 4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at **[75]** percent of rated

2.4 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

- 1. Outdoor Locations: NEMA 250, Type 3R.
- 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
- 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.5 FACTORY FINISHES

- A. Manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with mounting and anchoring requirements specified in Division 16 Section "Seismic Controls for Electrical Work."
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "[**Basic Materials and Methods**] Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.4 CONNECTIONS

- A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.
- B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.
- C. 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 and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
2. Test continuity of each line- and load-side circuit.

B. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. remedial action taken, and observations after remedial action.

3.6 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.7 CLEANING

- A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16410

SECTION 16442 - PANELBOARDS

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 load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
 - 1. Lighting and appliance branch-circuit panelboards.
 - 2. Distribution panelboards.
 - 3. Transient voltage surge suppressor panelboards.
- B. Related Sections include the following:
 - 1. Division 16 Section "Fuses."
 - 2. Division 16 Section "Seismic Controls for Electrical Work."
 - 3. Division 16 Section "Electrical Power Monitoring and Control."

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. RMS: Root mean square.
- C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
- B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- C. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.7 EXTRA MATERIALS

- A. Keys: **[Six]** spares of each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution & Control Div.
 - c. Siemens Energy & Automation, Inc.
 - d. Square D Co.

2.2 FABRICATION AND FEATURES

- A. Enclosures **[Flush- and surface-]**mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.

3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
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- B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - C. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 - E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
 - F. Bus: [**Hard-drawn copper, 98 percent conductivity**]
 - G. Main and Neutral Lugs: [**Compression**] type suitable for use with conductor material.
 - H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
 - I. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
 - J. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
 - K. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
 - L. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
 - M. Split Bus: Vertical buses divided into individual vertical sections.
 - N. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - O. Gutter Barrier: Arrange to isolate individual panel sections.
 - P. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.
 - Q. Feed-through Lugs: [**Compression**] type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.
- B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
- B. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: **[Mechanical]** style, suitable for number, size, trip ratings, and material of conductors.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. removable only when circuit breaker is in off position.
 - 4. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

2.5 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 16 Section "Seismic Controls for Electrical Work."
- C. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
- D. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- F. Install filler plates in unused spaces.
- G. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- H. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

2.6 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "**[Basic Electrical Materials and Methods]** Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

2.7 CONNECTIONS

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. 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 and UL 486B.

2.8 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

2.9 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

2.10 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16442