

PROJECT MANUAL

DIVISIONS 00-33
VOLUME 1 of 1

THE RIVANA @ RIVER DISTRICT

LOT 5B – MULTIFAMILY + COMMERCIAL

1494 TCHOUPITOULAS STREET
NEW ORLEANS, LA 70130

GMP DOCUMENTS
OCTOBER 30, 2025

RDNI BATTURE, LLC

400 POYDRAS ST., STE. 2620
NEW ORLEANS, LA 70130
504.291.6100

TPA PROJECT #: CN22194

GIBBS CONSTRUCTION

5736 CITRUS BLVD, STE. 200
NEW ORLEANS, LA 70123
504.733.4336



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Office of Workforce Development

Proposed Regulations Governing Implementation of the Hire NOLA Ordinance With Respect to First Source, Participation Goals, and Continued Compliance

I. Authority.

Pursuant to Chapter 70, Article IV, Division 3 of the Code of the City of New Orleans, The Office of Workforce Development (OWD) shall promulgate rules and regulations to implement the provisions of said division, which established Hire NOLA, which links quality employment opportunities to local workers.

II. Applicability.

These regulations apply to “covered projects” as defined by Section 70-498 of the Code of the City of New Orleans.

III. First Source.

1. Any individual who is domiciled in the City of New Orleans and desires potential employment opportunities may submit to OWD information requested by OWD, which shall include, if applicable, but is not limited to their:
 - i. Name,
 - ii. Address,
 - iii. Phone number,
 - iv. E-mail,
 - v. Skill-set or specialization,
 - vi. Prior work history/experience,
 - vii. References indicating positive prior work performance, and
 - viii. Certifications.

OWD shall maintain a First Source database whereby all such submitted information is stored.

2. OWD shall state on their website, and on any form provided to individuals seeking to be registered on OWD’s First Source database, that the provided information may be subject to public record.
3. Contractors on “covered projects” shall submit to OWD a Craft Employee Request Form for vacancies on said projects as provided herein.

4. OWD shall provide said Contractors a list of all registered individuals on the First Source database that are qualified for employment to fill vacancies on “covered projects” within five (5) working days.
5. OWD shall determine the individuals on the First Source database that are qualified for employment to fill vacancies on “covered projects.”
6. Contractors’ shall only consider the OWD-provided qualified First Source individuals to fill vacancies on “covered projects” during the five (5) working day period, as required by Sec. 70-500 of the Code of the City of New Orleans.
7. Qualified, as provided herein, shall mean individuals who possess a needed skill-set, specialization, or qualification that meets the requirements to fill a particular vacancy.

IV. Local Participation Goals.

1. As provided in Sec. 70-499 of the Code of the City of New Orleans, Contractors and their Subcontractors, if applicable, shall commit to making Good Faith Efforts to achieve local participation goals.
2. Within three (3) working days of bid opening, the two (2) lowest Bidders for “covered project” contracts shall submit form OWD-GF, whereby a bidder commits to making Good Faith Efforts, attesting that if the contract is awarded, Contractor will:
 1. Utilize OWD’s Craft Employee Request Form to inform OWD of any potential vacancies on a “covered project.”
 2. Contact qualified individuals from the First Source database, as provided by OWD, for filling potential vacancies.
 3. Solicit in the official journal of the City, or any other local publication, and advertise as provided below, any potential vacancies for local workforce candidates if First Source individuals are ultimately not qualified or available.
 4. Advertise vacancies at local Union/Hiring Halls of registered apprenticeship programs, if applicable.
 5. Advertise vacancies at the job site.
 6. Conduct meeting(s) with potential managers and subcontractors to educate said individuals regarding the Local Hire goals provided herein.
 7. Utilize registered apprenticeship programs at a 1 apprentice to 3 journeyman ratio, if applicable and available.
3. The advertisement referenced in subpart-2 shall include, but is not limited to:
 1. A description of position(s);
 2. The desired candidate qualifications;
 3. Wage rate;

4. The application deadline;
 5. Notice that an applicant's information may be subject to public record; and
 6. Contractor contact information.
4. Within three (3) working days of bid opening, the two (2) lowest Bidders must submit a "Local-Hire Plan", whereby the potential Contractor outlines how they will attempt to reach the goal(s) provided in Sec. 70-499, or attest that they currently meet the goals of Sec. 70-499, will continue to make efforts to maintain said goals, and submit supporting documentation indicating goal compliance.
 5. Within three (3) working days of bid opening, the two (2) lowest Bidders must submit a "Manpower Utilization Schedule" that contains an approximation of needed craft and unskilled workers throughout the duration of the project.
 6. Failure of a Bidder to submit the above documentation when required as part of an Invitation to Bid, Request for Proposals, or Request for Qualifications, may render the bid, proposal, or statement of qualifications non-responsive to that solicitation.

V. Records.

1. The Contractor awarded the "covered project" contract shall submit to OWD a Craft Employee Request Form for any potential vacancy on a "covered project" within five (5) days of contract execution.
2. The Contractor awarded the "covered project" contract shall submit to OWD the following documentation within forty-five (45) calendar days of contract execution, indicating Contractor's attempted compliance with form OWD-GF:
 - i. The names of qualified individuals from the First Source database that were contacted to fill any potential vacancies.
 - ii. The names of individuals hired from the First Source list, if any.
 - iii. Brief description as to why First Source individuals were not hired, if applicable.

If vacancies on "covered projects" were not able to be filled by qualified First Source individuals, the Contractor must timely submit additional documentation to indicate Good Faith Efforts, which should include but is not limited to:

- i. Copies of advertisements.
 - ii. Photos and/or copies of advertisement(s) at Union/Hiring Hall(s) and at the job site, if applicable.
 - iii. Names and addresses of local individuals that responded to the advertisements.
 - iv. Names of local individuals hired due to local advertising efforts.
3. The Contractor shall submit to OWD an attestation of the number and percentage of local workers on a "covered project," and a workforce roster providing the names

and addresses of the individuals that may work on the “covered project”. The workforce roster shall be submitted within forty-five (45) calendar days of contract execution, and shall be updated as needed to reflect modifications as contemplated in subpart VI.

4. Contractors shall utilize OWDs Contract Compliance Monitoring System to maintain payroll records of all craft employees on “covered projects”.

VI. Continued Compliance.

1. Contractor shall inform OWD in writing within three (3) working days if a local worker hired pursuant to achieving local hire goals quits, is transferred, is terminated, or otherwise ceases their involvement with the “covered project” for any reason.
2. Contractor shall make best efforts to hire another local worker for replacement, and work with OWD to utilize First Source individuals for replacement and recruitment for new employment opportunities throughout the life of the contract, if available.
3. Contractors shall submit monthly reports to OWD via OWDs Contract Compliance Monitoring System.

VII. Periodic Review

1. OWD must conduct an annual periodic policy review to determine the appropriate participation goals as provided in Sec. 70-499 of the Code of the City of New Orleans. The OWD review shall:
 - i. Consider whether there is a sufficient supply of qualified unemployed resident workers to meet the increased participation rates set forth in the ordinance;
 - ii. Recommend steps the City can take to support apprenticeship utilization on city-funded construction projects to help build a qualified local workforce;
 - iii. Make relevant findings in support of those determinations;
 - iv. During the periodic review process, shall consult with relevant stakeholders including the community and the Hire NOLA Committee; and
 - v. Upon completion of a periodic review, OWD shall make the report available to the public.
2. OWD will work with the New Orleans Workforce Development Board, a federally created local Workforce Development Board in the State of Louisiana under the Workforce Innovation and Opportunity Act (WIOA) (as the same may be hereafter amended, the “Act”), to designate a committee called the “Hire NOLA Committee” that will assist OWD with monitoring and compliance, investigation of worker complaints, and the Periodic Review of the Hire NOLA Ordinance.

VIII. Monitoring and Compliance

1. OWD has the authority to monitor “covered project” contracts to ensure continued compliance with the goals and Good Faith Efforts provided herein, and may request additional documentation to evaluate as needed.
2. OWD may monitor a “covered project” by a variety of means, which may include but are not limited to:
 - a. Job site visits,
 - b. Review of data submitted via the Contract Compliance Monitoring System, including payroll tracking;
 - c. Reviewing of records and reports;
 - d. Receipt of complaints by workers themselves and/or
 - e. Interviews of selected personnel.
3. When a Contractor fails to comply with First Source or fails to make Good Faith Efforts to achieve local participation goals, OWD shall contact the Contractor to offer assistance and ways to resolve the failure.
4. If the failure is not resolved, or if the Contractor fails again to comply after a resolution, OWD shall send the Contractor a notice of non-compliance.
5. If the Contractor continues to fail to comply or the Contractor repeatedly fails to comply, such continued and/or repeated non-compliance may constitute a material breach, as provided in the contract.
6. Continued noncompliance may be considered in future procurement and contract determinations.

IX. Hiring Discretion.

Nothing contained herein shall limit a Contractor or its subcontractors’ ability to assess qualifications of prospective candidates and to make final hiring and retention decisions. No provision of this Rule shall be interpreted as a requirement for Contractors or their subcontractors to employ any candidate not qualified for the position in question, or to employ any particular candidate.

003132 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' and Contractor's convenience and information and are intended to supplement rather than serve in lieu of Bidders' and Contractor's own investigations. This Document and its attachments are not part of the Contract Documents.
- B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.
- C. A geotechnical investigation report, including soil boring data for Project, prepared by Southern Earth Sciences., dated December 21, 2022, is available for viewing as appended to this Project Manual.
 - 1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
 - 2. Any party using the information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

END OF DOCUMENT

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Small and Emerging Business - Disadvantaged Business Enterprise (SEB-DBE) Compliance

River District Neighborhood Investors LLC

Form 1.A. - SEB-DBE Participation Plan - SUMMARY (Page 2 of 2)

Check One:

☐ Original Submission

☐ Amended Submission

☐ Final Submission

Development Entity Name _____

Date _____

RDNI Contract Number _____

Bid/Proposal Amount \$ _____ -

Excluded Amount \$ _____ -

Net Total Development Costs \$ _____ -

SEB-DBE Total \$ _____ -

SEB-DBE Percentage _____

Description _____

Name of Bidder/Proposer _____

List exclusions to Net Total Development Costs below. Attach supporting documentation.

Exclusions	Reason for Exclusion	Amount Excluded	Change Order (Check Amended Submission)	Office Use
<u>Soft Cost</u>				
<u>Hard Cost</u>				
Total Exclusions		\$ _____ -		

I hereby certify that the information contained herein is true and correct.

Print Name _____

Signature _____

Title _____

Date _____

[illegible]

SECTION 006000 – PROJECT FORMS

1.1 FORM OF AGREEMENT AND GENERAL CONDITIONS

- A. AIA Document A102, "Standard Form of Agreement between Owner and Contractor, where the basis of payment is the Cost of the Work Plus a Fee with a Guaranteed Maximum Price."
 - 1. The General Conditions for Project are AIA Document A201, "General Conditions of the Contract for Construction."
 - 2. The General Conditions form is hereby incorporated by reference.
 - 3. The Supplementary Conditions for the Project or Project-specific modifications to the General Conditions are available from the Owner.

1.2 ADMINISTRATIVE FORMS

- A. Administrative Forms: Additional administrative forms are specified in Division 01 General Requirements.
- B. Copies of AIA standard forms may be obtained from the American Institute of Architects; <http://www.aia.org/contractdocs/purchase/index.htm>; docspurchases@aia.org; (800) 942-7732.
- C. Preconstruction Forms:
 - 1. Form of Performance Bond and Labor and Material Bond: AIA Document A312, "Performance Bond and Payment Bond."
 - 2. Form of Certificate of Insurance: AIA Document G715, "Supplemental Attachment for ACORD Certificate of Insurance 25-S."
- D. Information and Modification Forms:
 - 1. Form for Requests for Information (RFIs): Bound in the Project Manual, or comparable form part of Web-Based Project Management System acceptable to Architect.
 - 2. Form of Request for Proposal: AIA Document G709, "Work Changes Proposal Request."
 - 3. Change Order Form: AIA Document G701, "Change Order" or comparable form part of Web-Based Project Management System acceptable to Architect.
 - 4. Form of Architect's Memorandum for Minor Changes in the Work (Work Order): AIA Document G707, "Architect's Supplemental Instructions" or comparable form part of Web-Based Project Management System acceptable to Architect
 - 5. Form of Change Directive (Work Order): AIA Document G714, "Construction Change Directive."
- E. Payment Forms:
 - 1. Schedule of Values Form: AIA Document G703, "Continuation Sheet" or comparable form part of Web-Based Project Management System acceptable to Architect
 - 2. Payment Application: AIA Document G702/703, "Application and Certificate for Payment and Continuation Sheet" or comparable form part of Web-Based Project Management System acceptable to Architect
 - 3. Form of Contractor's Affidavit: AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 - 4. Form of Affidavit of Release of Liens: AIA Document G706A, "Contractor's Affidavit of Payment of Release of Liens."
 - 5. Form of Consent of Surety: AIA Document G707, "Consent of Surety to Final Payment."

END OF SECTION

CONTRACTOR'S INTERIM LIEN AND CLAIM WAIVER AND RELEASE UPON PROGRESS PAYMENT

STATE OF:

COUNTY OF:

The undersigned, (Contractor), who has, under agreement with RDNI Batture, LLC (Owner), furnished materials, equipment, services and/or labor for the Project known as 1480 Tchoupitoulas St. and is located in New Orleans, Louisiana, County of Orleans Parish, State of Louisiana, and is more particularly described as follows:

Upon receipt of the sum of U.S. \$ (Current Payment), Contractor waives and releases any and all liens or claims against the Project and the Property and all claims, demands, actions, causes of action or other rights at law, in contract, equity or otherwise for payment for all work, materials, equipment, services, labor and any other items performed or provided that Contractor has or may have against RDNI Batture, LLC (Owner) through the date of (last day of the work period covered by pay application #) and reserving those rights and liens that Contractor might have in any retained amounts on account of materials, equipment, services and/or labor furnished by Contractor to or on account of Owner or any other entity for the Project. Exceptions as follows:

(If no exception entry or "none" is entered above, Contractor shall be deemed not to have reserved any claim).

Contractor further represents that all employees, laborers, material-men, Sub-Trade Contractors, Sub-Sub Trade Contractors and Sub Consultants employed by Contractor in connection with the Project have been paid for all work, materials, equipment, services, labor, and any other items performed or provided through (date of last prior application for payment).

Exceptions as follows:

(If no exception entry or "none" is entered above, all such payments have been made).

This Contractor's Interim Lien and Claim Waiver is freely and voluntarily given and Contractor acknowledges and represents that it has fully reviewed the terms and conditions of this Contractor's Interim Progress Lien and Claim Waiver, that it is fully informed with respect to the legal effect of this Contractor's Interim Progress Lien and Claim Waiver, that it has voluntarily chosen to accept the terms and conditions of this Final Progress Lien and Claim Waiver in return for the payment recited above.

FOR :

Applicable to Invoice(s) No.

Signed:

By:

Title:

Date:

CONTRACTOR'S INTERIM LIEN AND CLAIM WAIVER AND RELEASE UPON PROGRESS PAYMENT

STATE OF:

COUNTY OF:

The undersigned, (Contractor), who has, under agreement with RDNI Batture, LLC (Owner), furnished materials, equipment, services and/or labor for the Project known as 1480 Tchoupitoulas St. and is located in New Orleans, Louisiana, County of Orleans Parish, State of Louisiana, and is more particularly described as follows:

Upon receipt of the sum of U.S. \$ (Current Payment), Contractor waives and releases any and all liens or claims against the Project and the Property and all claims, demands, actions, causes of action or other rights at law, in contract, equity or otherwise for payment for all work, materials, equipment, services, labor and any other items performed or provided that Contractor has or may have against RDNI Batture, LLC (Owner) through the date of (last day of the work period covered by pay application #) and reserving those rights and liens that Contractor might have in any retained amounts on account of materials, equipment, services and/or labor furnished by Contractor to or on account of Owner or any other entity for the Project. Exceptions as follows:

(If no exception entry or "none" is entered above, Contractor shall be deemed not to have reserved any claim).

Contractor further represents that all employees, laborers, material-men, Sub-Trade Contractors, Sub-Sub Trade Contractors and Sub Consultants employed by Contractor in connection with the Project have been paid for all work, materials, equipment, services, labor, and any other items performed or provided through (date of last prior application for payment).

Exceptions as follows:

(If no exception entry or "none" is entered above, all such payments have been made).

This Contractor's Interim Lien and Claim Waiver is freely and voluntarily given and Contractor acknowledges and represents that it has fully reviewed the terms and conditions of this Contractor's Interim Progress Lien and Claim Waiver, that it is fully informed with respect to the legal effect of this Contractor's Interim Progress Lien and Claim Waiver, that it has voluntarily chosen to accept the terms and conditions of this Final Progress Lien and Claim Waiver in return for the payment recited above.

FOR :

Applicable to Invoice(s) No.

Signed:

By:

Title:

Date:

Superseded General Decision Number: LA20240001

State: Louisiana

Construction Type: Residential

Counties: Acadia, Ascension, Bossier, Caddo, Calcasieu, East Baton Rouge, Jefferson, Lafayette, Lafourche, Livingston, Orleans, Ouachita, Plaquemines, Rapides, St Bernard, St Charles, St James, St John the Baptist, St Landry, St Martin, St Tammany, Terrebonne, Webster and West Baton Rouge Counties in Louisiana.

RESIDENTIAL CONSTRUCTION PROJECTS (consisting of single family homes and apartments up to and including 4 stories)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at

<http://www.dol.gov/whd/govcontracts>.

Modification Number	Publication Date
0	01/03/2025
1	01/24/2025
2	04/04/2025
3	05/02/2025
4	06/20/2025
5	09/12/2025
6	09/19/2025

ELEC0130-003 12/02/2024

JEFFERSON, LAFOURCHE, ORLEANS, PLAQUEMINES, ST. BERNARD, ST. CHARLES, ST. JAMES, ST. JOHN THE BAPTIST, ST. MARTIN (Southern Portion), and TERREBONNE PARISHES

Rates	Fringes

ELECTRICIAN (including low voltage wiring and installation of fire alarms and security systems).....\$ 35.00	16.03

* ELEC0194-002 09/02/2025

BOSSIER, CADD0, and WEBSTER PARISHES

Rates	Fringes

ELECTRICIAN (including low voltage wiring and installation of fire alarms and security systems).....\$ 35.85	15.58

* ELEC0446-002 03/01/2025

OUACHITA PARISH

Rates	Fringes

ELECTRICIAN (including low voltage wiring and installation of fire alarms and security systems).....\$ 29.55	2%+13.77

ELEC0576-003 09/01/2025

RAPIDES PARISH

Rates	Fringes

ELECTRICIAN (including low voltage wiring and installation of fire alarms and security systems).....\$ 30.00	4.25%+10.75

ELEC0861-002 09/01/2024

ACADIA, CALCASIEU, LAFAYETTE, AND ST. MARTIN (Northern Portion) PARISHES

	Rates	Fringes
ELECTRICIAN (including low voltage wiring and installation of fire alarms and security systems).....	\$ 31.98	4.34%+13.75

ELEC0995-003 01/01/2025		

ASCENSION, EAST BATON ROUGE, LIVINGSTON, ST. LANDRY, AND WEST BATON ROUGE PARISHES

	Rates	Fringes
ELECTRICIAN (including low voltage wiring and installation of fire alarms and security systems).....	\$ 29.47	13.50

ELEC1077-006 05/26/2025		

ST. TAMMANY PARISH

	Rates	Fringes
ELECTRICIAN (including low voltage wiring and installation of fire alarms and security systems).....	\$ 30.35	3%+11.55

PLUM0060-005 06/05/2023		

JEFFERSON, LAFOURCHE, ORLEANS, PLAQUEMINES, ST. BERNARD, ST. CHARLES, ST. JAMES (Southeastern Portion), ST. JOHN THE BAPTIST, ST. TAMMANY, AND TERREBONNE PARISHES

	Rates	Fringes
PLUMBER (including HVAC pipe)....	\$ 31.70	13.85

PLUM0141-003 08/01/2023		

BOSSIER, CADD0, and WEBSTER PARISHES

	Rates	Fringes
PLUMBER (including HVAC pipe)....	\$ 28.48	14.47

PLUM0141-008 08/01/2024		

OUACHITA PARISH

	Rates	Fringes
PLUMBER (including HVAC pipe)....	\$ 28.75	11.86

PLUM0198-002 12/08/2022		

ASCENSION, EAST BATON ROUGE, LIVINGSTON , ST. JAMES (Northwestern Portion), ST. MARTIN (Eastern Portion), AND WEST BATON ROUGE PARISHES

	Rates	Fringes
PLUMBER (including HVAC pipe)....	\$ 32.42	16.50

PLUM0198-009 06/01/2014		

ACADIA, CALCASIEU, LAFAYETTE, ST. LANDRY, and ST. MARTIN
(Western Portion) PARISHES

	Rates	Fringes
PLUMBER (including HVAC pipe)....	\$ 25.90	13.65

PLUM0247-004 05/01/2020		

RAPIDES PARISH

	Rates	Fringes
PLUMBER (including HVAC pipe)....	\$ 26.50	13.39

SHEE0214-003 07/01/2009		

Jefferson, Lafourche, Orleans, Plaquemines, St. Bernard, St.
Charles, St. James, St. John the Baptist, St. Tammany, and
Terrebonne Parishes

	Rates	Fringes
SHEET METAL WORKER (includes HVAC Duct).....	\$ 24.54	9.65

SHEE0214-005 02/01/2009		

Acadia, Ascension, Calcasieu, East Baton Rouge, Lafayette,
Livingston, St. Landry, St. Martin, and West Baton Rouge
Parishes

	Rates	Fringes
SHEET METAL WORKER (includes HVAC Duct).....	\$ 24.37	9.205

SHEE0361-004 07/01/2012		

BOSSIER, CADDO, OUACHITA, RAPIDES, AND WEBSTER PARISHES

	Rates	Fringes
Sheet Metal Worker (including HVAC duct).....	\$ 26.09	10.22+3%

* SULA2004-012 06/15/2004		

	Rates	Fringes
CARPENTER (including drywall hanging, metal stud installation, and formbuilding/formsetting).....	\$ 11.78 **	0.00
Laborer, common.....	\$ 8.01 **	0.00

PAINTER

Brush, Roller, and Spray....	\$ 11.38 **	.83
Drywall Finishing.....	\$ 12.71 **	.78

Power Equipment Operator

Crane.....	\$ 13.00 **	0.00

ROOFER.....	\$ 10.11 **	2.01

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$17.75) or 13658 (\$13.30). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was

prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which

the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.

Washington, DC 20210.

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END OF GENERAL DECISION"

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Owner-furnished/Contractor-installed (OFCI) products.
4. Owner-furnished/Owner-installed (OFOL) products.
5. Contractor's use of site and premises.
6. Work restrictions.
7. Specification and Drawing conventions.
8. Miscellaneous provisions.

1.2 DEFINITIONS

- A. Contractor: The entity holding a prime contract with the Owner.
- B. Installer: The trade or subcontractor holding a contract with the Contractor.

1.3 PROJECT INFORMATION

- A. Project Identification: The Rivanna @ River District.
 1. Project Location: 1480 Tchoupitoulas St., New Orleans, LA 70130.
- B. Owner: RDNI Batture, LLC; 400 Poydras St., Ste. 2620; New Orleans, LA 70130
 1. Owner's Representative: Wendy Heath, Project Manager; Cumming Group; 1 Music Circle, Ste. 430; Nashville, TN 37203; wendy.heath@cumming-group.com
- C. Contractor: Gibbs Construction, 5736 Citrus Blvd., Ste. 200, New Orleans, LA 70130.
- D. Architect: Trapolin-Peer Architects, 850 Tchoupitoulas St., New Orleans, LA 70130; (504) 523-2772; www.trapolinpeer.com.
 1. Architect's Representative: Sara Simonsen AIA; ssimonsen@trapolinpeer.com.
- E. Architect's Consultants: Architect has retained the design professionals indicated on the Drawing Title Sheet who have prepared designated portions of the Contract Documents.
- F. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.
 1. See Section 013100 "Project Management and Coordination." for requirements for using web-based Project software.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Project, briefly and without force and effect upon the Contract Documents, can be summarized as follows:
 - 1. 4-story new construction mixed use multifamily building in the New Orleans River District, wood framed, building housing 220 apartment units, with retail on the ground floor and an open parking garage structure. Ancillary uses include leasing offices, residential amenities, community room, fitness room, pool and courtyard spaces.
- B. Code Notes:
 - 1. Occupancy and Construction Type are described on the Drawings.
- C. Construction Notes: New construction consists of:
 - 1. Timber pile-supported cast in place concrete foundation.
 - 2. Exterior sitework for public sidewalks/landscaping, surface parking lot, and courtyard amenity space, including a swimming pool.
 - 3. Wood framing is used for structural systems with a limited amount of structural steel and CMU at shafts/shear walls. Floor structural system is engineered wood joists, and roof structural system is engineered wood joists.
 - 4. Exterior cladding is comprised of brick veneer, formed metal wall panels, cement plaster, and both storefront and vinyl windows.
 - 5. New roofing will be low slope TPO membrane on rigid insulation over a wood deck.
 - 6. Project requirements include Fortified Gold Multifamily Certification, and Enterprise Green Communities Certification.
 - 7. The Work includes mockups.

1.5 WORK PERFORMED BY OWNER

- A. Not applicable.

1.6 WORK UNDER OWNER'S SEPARATE CONTRACTS

- A. Work with Separate Contractors: Cooperate fully with Owner's separate contractors, so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under Owner's separate contracts.
- B. Preceding Work: Owner has awarded separate contract(s) for the following construction operations adjacent to Project site. Those operations are scheduled to be substantially complete before Work under this Contract begins.
 - 1. New district/site infrastructure, including adjacent new streets, new utilities including those required for project tie-in, and underground site stormwater retention located on adjacent Parcel 5a.
- C. Concurrent Work: Owner has awarded or will award separate contracts for the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.
 - 1. Testing and laboratory services.

2. New pile-supported cast-in-place concrete egress “porch”. This work is located on adjacent Parcel 5a but installation is required for this project prior to occupancy. Porch will tie-in to this project’s foundation at gridline T.

1.7 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

- A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
 1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
 2. Provide for delivery of Owner-furnished products to Project site.
 3. Upon delivery, inspect, with Contractor present, delivered items.
 - a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
 4. Obtain manufacturer's inspections, service, and warranties.
 5. Inform Contractor of earliest available delivery date for Owner-furnished products.
- B. Contractor's Responsibilities: The Work includes the following, as applicable:
 1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
 2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
 3. Receive, unload, handle, store, protect, and install Owner-furnished products.
 4. Make building services connections for Owner-furnished products.
 5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
 6. Repair or replace Owner-furnished products damaged following receipt.
- C. Owner-Furnished/Contractor-Installed (OFCI) Products:
 1. Trash Compactor.

1.8 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

- A. The Owner will furnish and install products indicated on Drawings by OFOI or NIC.
 1. Fitness Room equipment.
 2. Vending equipment.
 3. Amenity and leasing office loose furnishings and decorations, including leasing office and amenity space window coverings.

1.9 CONTRACTOR'S USE OF SITE AND 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.

1.10 COORDINATION WITH OCCUPANTS

- A. Not applicable.

1.11 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. Traffic Control: Maintain boundary, adjacent, and access roads used by Contractor under permit or otherwise, regardless of status, classification, or ownership, during the Work. Perform maintenance as required to keep roads passable and usable by others without inconvenience or delay. Provide traffic control at no additional cost to the Owner.
 - 1. Provide and maintain traffic control devices on dedicated streets and highways including but not limited to signals, barriers, flares, lights, and flagmen as required by authorities having jurisdiction when construction operations conflict with the movement of vehicular or pedestrian traffic.
- C. Clean Roads: At the end of each workday during construction of the project, clean streets used for hauling construction materials and entrance to the construction site free of mud, dirt, trash, allaying dust, and debris resulting from hauling activities. Ensure that all streets and sidewalks adjacent to the construction site are free of trash and debris.
- D. Road Surfaces: Maintain Street surfaces adjacent to Project Site in smooth condition devoid of potholes throughout construction period. Whenever a significant portion of an adjacent road surface is disturbed for reasons relating to the construction, including utility work, the Contractor shall promptly repair the disturbed portions with hot patching to return the road surface to a smooth condition. The term "significant portion of the road" is understood to include, but not be limited to, a cut in the road surface that exceeds 10 feet in length or 100 square feet in area.
- E. Maintenance of Building Site: Maintain the building site and any buildings located within it in well-maintained condition throughout construction. This shall include, but not be limited to maintaining landscaping, keeping grass and undergrowth moved, removing litter and debris from the site, and properly disposing of recyclable materials.
- F. Accident Prevention and Safety: Comply with all applicable laws, ordinances, rules, regulations and orders of governing authorities having jurisdiction for the safety of persons and property to protect them from damage, injury or loss.
 - 1. Contractor is solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Project.
 - 2. Comply with AGC's "Manual of Accident Prevention in Construction" in addition to accident prevention and safety requirements of applicable codes, ordinances, and statutes.
 - 3. Erect and maintain, as required by conditions and progress of the work, necessary safeguards for safety and protection, including fences, railings, barricades, lighting, posting of danger signs and other warnings against hazards.
 - 4. Build scaffolds and other temporary facilities in accordance with all requirements of local, state and Federal laws and regulations.

1.12 PROJECT MANUAL

- A. This Project Manual is the volume assembled for the Work which may include the Procurement Requirements, Contracting Requirements, General Requirements Specifications, and individual Specifications sections as indicated in the Table of Contents and may include but is not limited to the following distinct parts:

B. Division 00 Bidding and Contracting Requirements:

1. Not part of the Contract unless incorporated by reference in a Contracting Requirements document.
2. Not specifications.

C. Division 01 General Requirements:

1. Expand upon requirements of General Conditions.
2. Describe administrative and procedural requirements that apply to all individual specification sections of all design disciplines included in the Project Manual.
3. Part of the Contract.
4. Specifications.

D. Specifications (6- and 8- digit format):

1. Establish the quality levels of materials and systems required for the Project.
2. Division 02 – 19: Facility Construction.
3. Division 20 – 29: Facility Services (FP/PL/HVAC/EL/COMM).
4. Division 30 – 39: Site and Infrastructure.
5. Part of the Contract.

E. Appendices:

1. Not part of the construction contract unless incorporated by reference in a contracting requirements document.
2. Not specifications.

1.13 SPECIFICATION AND DRAWING CONVENTIONS

A. 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. Imperative mood and streamlined language are generally used in the Specifications. 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.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.

1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying 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 form provided in Project Manual, form that is part of web-based Project management software, or other form acceptable to Architect.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication, or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions 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 substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, **sustainable design characteristics**, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES, where available.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall

Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

- k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. 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 seven days 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 seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.6 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

- 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided for compliance with sustainable design requirements.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.

- h. Requested substitution provides specified warranty.
 - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.
 - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution provides sustainable design characteristics that specified product provided for compliance with sustainable design requirements.
 - e. Substitution request is fully documented and properly submitted.
 - f. Requested substitution will not adversely affect Contractor's construction schedule.
 - g. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - h. Requested substitution is compatible with other portions of the Work.
 - i. Requested substitution has been coordinated with other portions of the Work.
 - j. Requested substitution provides specified warranty.
 - k. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
 - 2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

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, or on web-based Project management software, as applicable to Project.

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. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, 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 costs of labor and supervision directly attributable to the change.
 - d. 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.
 - e. Quotation Form: Use forms acceptable to Architect.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
 - 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 costs of labor and supervision directly attributable to the change.
5. 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.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.4 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change 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

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one-line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

- a. Project name and location.
- b. Owner's name.
- c. Owner's Project number.
- d. Name of Architect.
- e. Architect's Project number.
- f. Contractor's name and address.
- g. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.

3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

- a. Related Specification Section or division.
- b. Description of the Work.
- c. Name of subcontractor.
- d. Name of manufacturer or fabricator.
- e. Name of supplier.
- f. Change Orders (numbers) that affect value.
- g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.

- 1) Labor.

- 2) Materials.
 - 3) Equipment.
 - 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - 5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
 - 6. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
 - 7. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
 - 8. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
 - 9. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.
- 1.4 APPLICATIONS FOR PAYMENT
- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.
 - B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
 - C. Payment Application Times: When not stipulated in the Owner/Contractor Agreement: Submit Application for Payment to Architect by the 25 of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
 - 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
 - D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
 - 1. Other Application for Payment forms proposed by the Contractor may be acceptable to Architect and Owner. Submit forms for approval with initial submittal of schedule of values.
 - E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.

3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
 2. Provide photographs of the stored material labeled with: product, project name, project address, stored address, and date.
 3. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 4. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- G. Record Documents: Submit, with each progress payment application, documentation of current maintenance of Project Record documents indicating changes since the last payment application.
- H. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- I. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.

3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Schedule of unit prices.
 6. Submittal schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
 15. Data needed to acquire Owner's insurance.
- K. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Certification of completion of final punch list items.
 3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 4. Updated final statement, accounting for final changes to the Contract Sum.
 5. AIA Document G706.
 6. AIA Document G706A.
 7. AIA Document G707.
 8. Evidence that claims have been settled.
 9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 10. Final liquidated damages settlement statement.
 11. Proof that taxes, fees, and similar obligations are paid.
 12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. RFIs.
 - 3. Digital project management procedures.
 - 4. Web-based Project management software package.
 - 5. Project meetings.

1.2 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. 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. Include the following information in tabular form:
 - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities, list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in Project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in built facility. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different 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 to ensure maximum performance and accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.
- B. 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 scheduled 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.
 8. Startup and adjustment of systems.
- 1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL
- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
- 1.6 REQUEST FOR INFORMATION (RFI)
- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Owner name.
 3. Owner's Project number.
 4. Name of Architect.
 5. Architect's Project number.
 6. Date.
 7. Name of Contractor.
 8. RFI number, numbered sequentially.
 9. RFI subject.
 10. Specification Section number and title and related paragraphs, as appropriate.
 11. Drawing number and detail references, as appropriate.
 12. Field dimensions and conditions, as appropriate.

13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 14. Contractor's signature.
 15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716 or software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow three days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
 3. Architect's action on RFIs that may result in a change to the Contract Time, or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web-based Project management software. Include the following:
1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number, including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three days if Contractor disagrees with response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model will be provided by Architect for Contractor's use during construction.
 - 1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
 - 2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
 - 3. Digital Drawing Software Program: Contract Drawings are available in.
 - 4. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.
 - a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.
 - 5. The following digital data files will be furnished for each appropriate discipline:
 - a. Floor plans.
 - b. Reflected ceiling plans.
- B. Web-Based Project Management Software Package: Provide, administer, and use web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.
 - 1. Web-based Project management software includes, at a minimum, the following features:
 - a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
 - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
 - c. Document workflow planning, allowing customization of workflow between project entities.
 - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
 - e. Track status of each Project communication in real time, and log time and date when responses are provided.
 - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
 - g. Processing and tracking of payment applications.
 - h. Processing and tracking of contract modifications.
 - i. Creating and distributing meeting minutes.
 - j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
 - k. Management of construction progress photographs.
 - l. Mobile device compatibility, including smartphones and tablets.

2. Provide up to seven Project management software user licenses for use of Owner, Owner's Commissioning Authority, Architect, and Architect's consultants.
3. Provide eight hours of software training at Architect's office for web-based Project software users.
4. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.
 - j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - l. Distribution of the Contract Documents.

- m. Submittal procedures.
 - n. Sustainable design requirements.
 - o. Preparation of Record Documents.
 - p. Use of the premises and existing building.
 - q. Work restrictions.
 - r. Working hours.
 - s. Owner's occupancy requirements.
 - t. Responsibility for temporary facilities and controls.
 - u. Procedures for moisture and mold control.
 - v. Procedures for disruptions and shutdowns.
 - w. Construction waste management and recycling.
 - x. Parking availability.
 - y. Office, work, and storage areas.
 - z. Equipment deliveries and priorities.
 - aa. First aid.
 - bb. Security.
 - cc. Progress cleaning.
- 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Sustainable Design Requirements Coordination Conference: Architect will schedule and conduct a sustainable design coordination conference before starting construction, at a time convenient to Owner Architect, and Contractor.
 - 1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent and sustainable design coordinator; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Discuss items of significance that could affect meeting sustainable design requirements, including the following:
 - a. Sustainable design Project checklist.
 - b. General requirements for sustainable design-related procurement and documentation.
 - c. Project closeout requirements and sustainable design certification procedures.
 - d. Role of sustainable design coordinator.
 - e. Construction waste management.
 - f. Construction operations and sustainable design requirements and restrictions.
 - 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- D.
- E. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
 - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and Owner's Commissioning Authority of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Sustainable design requirements.
 - i. Review of mockups.
 - j. Possible conflicts.
 - k. Compatibility requirements.
 - l. Time schedules.
 - m. Weather limitations.
 - n. Manufacturer's written instructions.
 - o. Warranty requirements.
 - p. Compatibility of materials.
 - q. Acceptability of substrates.
 - r. Temporary facilities and controls.
 - s. Space and access limitations.
 - t. Regulations of authorities having jurisdiction.
 - u. Testing and inspecting requirements.
 - v. Installation procedures.
 - w. Coordination with other work.
 - x. Required performance results.
 - y. Protection of adjacent work.
 - z. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- F. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of Record Documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.

- c. Procedures for completing and archiving web-based Project software site data files.
 - d. Submittal of written warranties.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for delivery of material samples, attic stock, and spare parts.
 - g. Requirements for demonstration and training.
 - h. Preparation of Contractor's punch list.
 - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - j. Submittal procedures.
 - k. Coordination of separate contracts.
 - l. Owner's partial occupancy requirements.
 - m. Installation of Owner's furniture, fixtures, and equipment.
 - n. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- G. Progress Meetings: Conduct progress meetings at biweekly intervals.
- 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site use.
 - 9) Temporary facilities and controls.
 - 10) Progress cleaning.
 - 11) Quality and work standards.
 - 12) Status of correction of deficient items.
 - 13) Field observations.
 - 14) Status of RFIs.
 - 15) Status of Proposal Requests.

- 16) Pending changes.
 - 17) Status of Change Orders.
 - 18) Pending claims and disputes.
 - 19) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. 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. Construction schedule updating reports.
 - 3. Special reports.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. PDF electronic file.
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- C. Construction Schedule Updating Reports: Submit with Applications for Payment.
- D. Special Reports: Submit at time of unusual event.

1.4 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including work stages, area separations, and partial Owner occupancy.
 - 4. Review delivery dates for Owner-furnished products and Owner work.
 - 5. Review submittal requirements and procedures.
 - 6. Review time required for review of submittals and resubmittals.
 - 7. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 8. Review time required for Project closeout and Owner startup procedures.
 - 9. Review and finalize list of construction activities to be included in schedule.
 - 10. Review procedures for updating schedule.

1.5 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by the Architect.
 - 2. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 3. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.
 - 1. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 2. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Seasonal variations.
 - g. Environmental control.
 - 3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.

- d. Mockups.
 - e. Fabrication.
 - f. Deliveries.
 - g. Installation.
 - h. Tests and inspections.
 - i. Adjusting.
 - j. Curing.
 - k. Startup and placement into final use and operation.
 - 4. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - D. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
 - 1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
 - E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 - 1. Unresolved issues.
 - 2. Unanswered Requests for Information.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
 - 5. Pending modifications affecting the Work and Contract Time.
 - F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)
- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed. Base schedule on the startup construction schedule and additional information received since the start of Project.
 - B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.
- 2.3 SPECIAL REPORTS
- A. General: Submit special reports directly to Architect and Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence. Report the following:
 - 1. Conditions of site affecting work performance or schedule.
 - 2. Procurement activities impacting project schedule.

3. Other events affecting Contract Sum or Contract Time.

- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Concealed Work photographs.
 - 3. Periodic construction photographs.
 - 4. Final Completion construction photographs.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
 - 2. Section 311000 "Site Clearing" for photographic documentation before site clearing operations commence.

1.2 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Submit photos by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
 - 2. Identification: Provide the following information with each image description in web-based Project management software site:
 - a. Name of Project.
 - b. Date photograph was taken.
 - c. Description of location, vantage point, and direction.
 - d. Unique sequential identifier keyed to accompanying key plan.

1.3 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years, or skilled employee with demonstrated record of successful completion of similar photographic work on a minimum of three previous projects.

1.4 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

- C. Metadata: Record accurate date and time from camera.
- D. File Names: Name media files with date, Project area, and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs with maximum depth of field and in focus.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag excavation areas and construction limits before taking construction photographs.
 - 2. Take 40 photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take 40 photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
 - 5. Include the following:
 - a. All interior areas
 - b. All exterior building surfaces.
 - c. All adjacent sidewalks and streets
 - d. Adjacent properties exterior, streets, sidewalks withing 100' of property line.
- D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
 - 1. Underground utilities.
 - 2. Underslab services.
 - 3. Piping.
 - 4. Electrical conduit.
 - 5. Waterproofing and weather-resistant barriers.
- E. Periodic Construction Photographs: Take 20 photographs weekly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
 - 1. Frequency: Take photographs weekly, on the same day each week.
 - 2. Vantage Points: Following suggestions by Architect and Contractor, photographer shall select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time, to create a time-lapse sequence as follows:
 - a. Commencement of the Work, through completion of subgrade construction.
 - b. Above-grade structural framing.
 - c. Exterior building enclosure.

d. Interior Work, through date of Substantial Completion.

F. Final Completion Construction Photographs: Take 50 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Information:

1. Section 018113 "Sustainable Design Requirements" for separate submittal requirements for achieving required certification.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.

- f. Scheduled date for Architect's final release or approval.
- g. Scheduled dates for purchasing.
- h. Scheduled date of fabrication.
- i. Scheduled dates for installation.
- j. Activity or event number.

1.4 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
 - 1. Project name.
 - 2. Date.
 - 3. Name of Architect.
 - 4. Name of Contractor.
 - 5. Name of firm or entity that prepared submittal.
 - 6. Names of subcontractor, manufacturer, and supplier.
 - 7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
 - 8. Category and type of submittal.
 - 9. Submittal purpose and description.
 - 10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 - 11. Drawing number and detail references, as appropriate.
 - 12. Indication of full or partial submittal.
 - 13. Location(s) where product is to be installed, as appropriate.
 - 14. Other necessary identification.
 - 15. Remarks.
 - 16. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
- E. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.5 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
- B. 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. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, 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.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 14 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- E. 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.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.
- 1.6 SUBMITTAL REQUIREMENTS
- A. 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 published data are unsuitable 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 catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. 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 unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.

3. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
 4. 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.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 5. 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. Number of Samples: Submit one 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.
 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: 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. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

- G. Certificates:
 - 1. Certificates and Certifications Submittals: Submit a 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. Provide a notarized signature where indicated.
 - 2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 - 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 - 4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
 - 5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
 - 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

- H. Test and Research Reports:
 - 1. Compatibility Test Reports: Submit 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 substrate preparation and primers required.
 - 2. Field Test Reports: Submit written reports 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 in the Contract Documents.
 - 3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 - 4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
 - 5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. 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.
 - 6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.

- f. Test procedures and results.
- g. Limitations of use.

1.7 DELEGATED-DESIGN SERVICES

- 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 insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file paper copies of certificate, 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.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with indication in web-based Project management software. Include 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.
 - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.
 - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.
 - 2. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.
 - a. Actions taken by indication on Project management software website have the following meanings:
- B. Informational Submittals: Architect will review each submittal and will not return it or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will discard submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection 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. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."
- H. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 DELEGATED-DESIGN SERVICES

- 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.
- B. Delegated-Design Services Statement: 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.

1.4 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 1. Date of issue.
 2. Project title and number.
 3. Name, address, telephone number, and email address 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. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and re-inspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement of whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement of whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

1.7 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged in the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

- G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:
 - 1. Provide test specimens representative of proposed products and construction.
 - 2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - 3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - 4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
 - 5. When testing is complete, remove test specimens and test assemblies, and temporary mockups; do not reuse products on Project.
 - 6. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

1.8 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
 - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 - 2. Payment for these services will be made from testing and inspection allowances specified in Section 012100 "Allowances," as authorized by Change Orders.
 - 3. Costs for retesting and re-inspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.

4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.
1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
 2. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.
- 1.9 SPECIAL TESTS AND INSPECTIONS
- A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in the Statement of Special Inspections included in the Contract Documents, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
 6. Retesting and re-inspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, and authorities' having jurisdiction reference during normal working hours.
1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
 - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
 1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
 2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 3. ICC - International Code Council; www.iccsafe.org.
 4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
 1. COE - Army Corps of Engineers; www.usace.army.mil.
 2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
 3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 4. DOD - Department of Defense; www.quicksearch.dla.mil.
 5. DOE - Department of Energy; www.energy.gov.
 6. EPA - Environmental Protection Agency; www.epa.gov.
 7. FAA - Federal Aviation Administration; www.faa.gov.
 8. FG - Federal Government Publications; www.gpo.gov/fdsys.
 9. GSA - General Services Administration; www.gsa.gov.
 10. HUD - Department of Housing and Urban Development; www.hud.gov.
 11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
 12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 13. SD - Department of State; www.state.gov.
 14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
 15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
 17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
 18. USP - U.S. Pharmacopeial Convention; www.usp.org.
 19. USPS - United States Postal Service; www.usps.com.
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
 2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.

3. DSCC - Defense Supply Center Columbus; (See FS).
 4. FED-STD - Federal Standard; (See FS).
 5. FS - Federal Specification; Available from DLA Document Services;
www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide;
www.wbdg.org.
 6. MILSPEC - Military Specification and Standards; (See DOD).
 7. USAB - United States Access Board; www.access-board.gov.
 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 3. CDHS; California Department of Health Services; (See CDPH).
 4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
 5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
 6. LHC; Louisiana Housing Corp.
 7. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
 8. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development;
www.txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 014300 – STRUCTURAL TEST AND SPECIAL INSPECTIONS**PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

- A. General provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Structural drawing S0.02, applies to this section
- C. Related Specifications, and/or scopes of work as included on the Drawings:
 - 1. 033000 - CAST-IN-PLACE CONCRETE
 - 2. 051200 - STRUCTURAL STEEL
 - 3. 061000 - ROUGH CARPENTRY
 - 4. 061400 – ENGINEERED LUMBER
 - 5. 312001 - EARTHWORK FOR BUILDING FOUNDATIONS
 - 6. 316200 - DRIVEN PILES

1.2 SUMMARY

- A. Scope: The provisions of this specification, in addition to Chapter 17 of the 2021 edition of the International Building Code, shall govern the quality, workmanship, and requirements for materials covered in this section.
- B. Structural testing and special inspection services are required to verify compliance with requirements specified or indicated. These services require the coordination and associated labor of the Contractor and do not relieve Contractor of responsibility for compliance with other construction document requirements.

1.3 APPROVALS

- A. The Owner shall employ an agency, which meets the requirements of Section 1703.1 of the International Building Code.
- B. The approved agency shall provide written approval, approved records, research and investigation data, labeling and testing as described in Section 1703 of the International Building Code.

1.4 MINIMUM QUANTITY OF TESTS AND INSPECTIONS

- A. The quantity of inspections required by the Schedule of Special Inspections or the Contract Documents shall be the minimum provided or performed. The actual number of inspections may comply exactly with the minimum quantity, or it may exceed the minimum within reasonable limits. An example where the number of inspections may exceed the required is establishing the proper soil compaction method. Once established, however, the quantity of inspections or tests performed shall generally be limited to those specified in the Contract Documents. Refer uncertainties to the registered design profession in responsible charge for a decision before proceeding.
- B. The Special Inspector's reports and testing agencies results shall have precedence over reports and test results provided by the Contractor.
- C. Retesting/Re-inspecting: Where the work of the Contractor is found to be out of compliance with the Contract Documents, the work will be removed or repaired at the Contractor's expense. All subsequent repairs are subject to retesting and re-inspection by the Owner's testing and inspection agency. The costs of these services will be borne by the Contractor.

1.5 STATEMENT OF STRUCTURAL SPECIAL INSPECTIONS

- A. The Owner's Special Inspector shall provide inspections during construction on the types of work listed in this Section.
 - 1. Inspection of Fabricators, in accordance with Section 1704.2.5 of the 2021 International Building Code, shall include the following:

- a. In-shop inspection of fabricated items.
 - b. Review of the fabricator's procedures and quality control measures to ensure proper control of workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
2. Steel: Refer to Section 1705.2 of the 2021 International Building Code.
3. Concrete Construction: Refer to Section 1705.3 of the 2021 International Building Code.
4. Masonry Construction: Refer to Section 1705.4 of the 2021 International Building Code. Masonry construction shall be inspected and verified in accordance with TMS 402/ACI 530/ASCE 5 and TMS 602/ACI 530.1/ASCE 6 quality assurance program requirements.
5. Soils: Refer to Section 1705.6 of the 2021 International Building Code.
6. Driven Pile Foundations: Refer to Section 1705.7 of the 2021 International Building Code.
7. Cast-in-Place Deep Pile Foundations: Refer to Section 1705.7 of the 2021 International Building Code.
- B. Special Inspections for Seismic Requirements:
 1. Special Inspections for Seismic Resistance not required.
- C. Special Inspections for Wind Requirements:
 1. Special Inspections for Wind Resistance shall be in accordance with 1705.12 of the 2021 International Building Code.
- C. Structural Observations:
 1. The Owner's Structural Observer shall be a Professional Engineer licensed in the State of Louisiana and shall perform observations in accordance with 1704.6 of the 2021 International Building Code.
 2. The Owner's Structural Observer shall submit to the building official at the conclusion of work included in the permit a written statement that the site visits have been made and identify any reported deficiencies that have not been resolved.

1.6 CONTRACTOR RESPONSIBILITY

- A. The Contractor shall coordinate the inspection and testing services with the progress of the work. The Contractor shall provide sufficient notice to allow proper scheduling of all personnel. The Contractor shall provide safe access for performing inspection and on-site testing.
- B. The Contractor shall perform associated services for the purpose of facilitating Structural Tests and Special Inspections. It will be the responsibility of the Contractor to do, as a minimum, the following:
 1. Notify Inspecting or Testing Agency a minimum of forty-eight hours in advance of operations to permit assignment of personnel.
 2. Cooperate with agencies performing required tests and/or inspections.
 3. Provide reasonable auxiliary services as requested.
 4. Provide access to the work.
 5. Provide incidental labor and facilities necessary to facilitate tests and inspections.
 6. Provide adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 7. Provide facilities for storage and field curing of test samples.
 8. Deliver samples to testing agencies.
 9. Security and protection for samples and for testing and inspecting equipment at project site.
- C. The Contractor shall repair and/or replace work that does not meet the requirements of the construction documents.
 1. Owner shall engage an engineer/architect to prepare repair and/or replacement procedures.
 2. Engineer/Architect shall be registered in the state in which the project is located. Engineer shall be acceptable to the Registered Design Professional in charge, Code Enforcement Official, and Owner.

3. Procedures shall be submitted for review and acceptance by the Registered Design Professional in responsible charge, Code Enforcement Official, and Owner before proceeding with corrective action.
- D. The Contractor shall be responsible for costs of:
 1. Re-testing and re-inspection of materials, work, and/or products that do not meet the requirements of the construction documents and shop drawings/submittal data.
 2. Review of proposed repair and/or replacement procedures by the Registered Design Professional in charge and the inspectors and testing agencies.
 3. Repair or replacement of work that does not meet the requirements of the construction documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 STRUCTURAL TESTING AND SPECIAL INSPECTION PROGRAM SUMMARY

- A. The parties involved shall complete and sign a Statement of Special Inspections (which includes a Schedule of Special Inspection Services) prepared by the Registered Design Professional in Responsible Charge and shall submit to the Building Official at the time of permit application.
- B. The Statement of Special Inspections must be maintained during the course of a construction project and reflect any changes.
- C. The Special Inspector(s) shall inspect the work per the schedule of Special Inspection services and provide daily report detailing the inspection and any deficiencies. The Special Inspector(s) shall issue interim reports to the design professional and the building official as noted in the statement of Special Inspections.
- D. At the completion of work and prior to issuing the Certificate of Occupancy, A Final Report of Special Inspections in accordance with the 2021 International Building Code Section 1704.5 shall be submitted to the Building Official. This report shall document the completion of all required special inspections and testing.
- E. Special inspection forms:

Statement of Special Inspections

PROJECT #: _____
 ADDRESS: _____
 APPLICANT: _____
 ARCHITECT OF RECORD: _____
 STRUCTURAL ENGINEER: _____
 MECHANICAL ENGINEER: _____
 ELECTRICAL ENGINEER: _____
 DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: _____

This Statement of Special Inspections is submitted in accordance with Chapter 17 of the 2021 International Building Code. It includes a *Schedule of Special Inspection Services* applicable to the above- referenced Project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections. If applicable, it includes *Special Inspections for Wind Resistance*. The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the Building Official and to the Registered Design Professional in Responsible Charge at a frequency agreed upon by the Design Professional and the Building Official prior to the start of work. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and corrections of any discrepancies noted in the inspections shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge at the conclusion of the project.

Frequency of interim report submittals to the Registered Design Professional in Responsible Charge:

____ Weekly ____ Bi-Weekly ____ Monthly Other; specify: _____

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Statement of Special Inspections Prepared by:

Type or print name

Signature Date

Building Official's Acceptance Signature:

Preparer's Seal

Contractor's Statement of Responsibility

Each contractor responsible for the construction or fabrication of a main wind or seismic force-resisting system, designated seismic system or wind or seismic- resisting component listed in the Statement of Special Inspections, Special Inspections for Seismic or Wind Resistance, must submit a Statement of Responsibility.

Project:

Contractor's Name:

Address:

Parish License No.

Description of building systems and components included in Statement of Responsibility:

Contractor's Acknowledgement of Special Requirements

I hereby acknowledge that I have received, read, and understand the Statement of Special Inspections and Special Inspection program:

I hereby acknowledge that control will be exercised to obtain conformance with the approved construction documents.

Name and Title (type or print)

Signature

Date

Fabricators Certificate of Compliance

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2.5.1 of the International Building Code must submit *Fabricator’s Certificate of Compliance* at the completion of fabrication.

Project: _____

Fabricator’s Name: _____

Address: _____

Certification or Approval Agency: _____

Certification Number: _____

Date of Last Audit or Approval: _____

Description of structural members and assemblies that have been fabricated:

(PLEASE ATTACH PAPER USED FOR EXTRA SPACE TO THIS DOCUMENT)

I hereby certify that items described above were fabricated in strict accordance with the approved construction documents.

Name and Title (type or print)

Signature

Date

Attach copies of fabricator’s certification or building code evaluation service report and fabricator’s quality control manual.

SPECIAL INSPECTION DAILY REPORT

PROJECT NAME / ADDRESS:									
INSPECTION TYPE(S) COVERAGE: ☐ CONTINUOUS ☐ PERIODIC TIME BEGINNING INSPECTION: TIME ENDING INSPECTION:									
DESCRIBE INSPECTIONS MADE, INCLUDING LOCATIONS:									
LIST TESTS MADE:									
TOTAL INSPECTION TIME EACH DAY									
LIST ITEMS REQUIRING CORRECTIONS, CORRECTIONS OF PREVIOUSLY LISTED ITEMS AND PREVIOUSLY LISTED UNCORRECTED ITEMS: PROVIDE COPIES OF DISCREPANCY NOTICES:									
COMMENTS:									
TO THE BEST OF MY KNOWLEDGE, WORK INSPECTED WAS IN ACCORDANCE WITH THE APPROVED DESIGN DRAWINGS, AND SPECIFICATIONS, EXCEPT AS NOTED ABOVE.									
PRINTED FULL NAME									
NOTE BY "SPECIAL INSPECTOR" OR NAME OF TESTING AGENCY									
SIGNED:						DATE:			
CERTIFICATION:						NUMBER:			

DISCREPANCY NOTICE No. _____

SPECIAL INSPECTION DISCREPANCY NOTICE

PROJECT NAME / ADDRESS:		
INSPECTION TYPE(S) COVERAGE ☐ CONTINUOUS ☐ PERIODIC		
AREA INSPECTED	TYPE OF INSPECTION	
NOTICE DELIVERED TO: ☐ CONTRACTOR ☐ ENGINEER/ARCHITECT ☐ OWNER	DATE:	TIME:
MAKE THE FOLLOWING CORRECTIONS AND SECURE INSPECTION APPROVAL PRIOR TO PROCEEDING WITH THIS PHASE OF THE WORK.		
PRINTED FULL NAME		
NOTE BY "SPECIAL INSPECTOR" OR PROVIDE NAME OF TESTING		
SIGNED:		DATE:
CERTIFICATION:		NUMBER:

Final Report of Special Inspection

PROJECT #: _____

ADDRESS: _____

APPLICANT: _____

ARCHITECT OF RECORD: _____

STRUCTURAL ENGINEER: _____

MECHANICAL ENGINEER: _____

ELECTRICAL ENGINEER: _____

DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: _____

To the best of my information, knowledge, and belief, which are based upon observations or diligent supervision of our inspection services for the above-referenced Project, I hereby state that the special inspections or testing required for this Project, and designated for this Agent in the *Statement of Special Inspection* have been completed in accordance with the Contract Documents.

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Interim reports submitted prior to this final report and numbered _____ to _____ form a basis for, and are to be considered an integral part of this final report. The following discrepancies that were outstanding since the last interim report dated _____ have been corrected.

Comments:

Prepared By:

Special Inspection Agent/Firm

Type or print name

Signature

Date

Preparer's Seal

END OF STRUCTURAL TESTS AND SPECIAL INSTRUCTIONS

SECTION 014339 - MOCKUPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. In-place mockups.
2. Integrated exterior mockups.

B. Related Requirements:

1. Section 014000 "Quality Requirements" for quality assurance requirements for aesthetic and workmanship mockups specified in other Sections.
2. Section 019119.43 "Exterior Enclosure Commissioning" for testing building enclosure systems and assemblies as part of the exterior enclosure commissioning process.

1.2 DEFINITIONS

- A. In-Place Mockups: Mockups of portions of the Work described in individual specification sections located in-situ and requiring Architect approval prior to Contractor proceeding with the remaining Work.
- B. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements, consisting of multiple products, assemblies, and subassemblies.
- C. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting as indicated.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, testing and inspecting agency representative, and installers of major systems whose Work is included in integrated exterior and room mockups.
2. Review coordination of equipment and furnishings provided by the Owner for room mockups.
3. Review locations and extent of mockups.
4. Review testing procedures to be performed on mockups.
5. Review and finalize schedule for mockups, and verify availability of materials, personnel, equipment, and facilities needed to complete mockups and maintain schedule for the Work.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior and room mockups.

1. Include plans, elevations, sections, and support details.
2. Indicate manufacturer and model number of individual components, subassemblies, and assemblies.
3. Include site location drawing.

4. Revise and resubmit Shop Drawings to reflect approved modifications in details and component interfaces resulting from changes made during testing procedures.

- B. Delegated Design Submittal: For temporary structural supports for mockups not attached to building structure, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Room Mockup Coordination Drawings: Drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved.
- B. Qualification Data: For testing agency.
- C. Preconstruction Test Reports: For integrated exterior mockups.

1.6 QUALITY ASSURANCE

- A. Build mockups to do the following:
 1. Verify selections made under Sample submittals.
 2. Demonstrate aesthetic effects.
 3. Demonstrate the qualities of products and workmanship.
 4. Demonstrate acceptable coordination between components and systems.
- B. Fabrication: Before fabricating or installing portions of the Work requiring mockups, build mockups for each form of construction and finish required. Use materials and installation methods as required for the Work.
 1. Build mockups in location indicated or, if not indicated, as directed by Architect.
 2. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 5. Demolish and remove mockups when directed unless otherwise indicated.
- C. Notifications:
 1. Notify Architect seven days in advance of the dates and times when mockups will be constructed.
 2. Notify Architect 14 days in advance of the dates and times when mockups will be tested.
 3. Allow seven days for initial review and each re-review of each mockup.
- D. Approval: Obtain Architect's approval of mockups before starting fabrication or construction of corresponding Work.
 1. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 COORDINATION

- A. Coordinate schedule for construction of mockups, so construction, testing, and review of mockups do not impact Project schedule.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design support structure for free-standing mockups.
- B. Structural Performance:
 - 1. Wind Loads: As indicated on Drawings.

2.2 IN-PLACE MOCKUPS

- A. Construct in-place mockups as indicated in individual specification sections. Construct mockups to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components, subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.
- B. Build in-place mockups using installers and construction methods that will be used in completed construction.
- C. Use specified products that have been approved by the Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work.

2.3 INTEGRATED EXTERIOR MOCKUPS

- A. Construct integrated exterior mockups according to approved mockup Shop Drawings. Construct mockups to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components, subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.
- B. Design and construct foundation and superstructure to support free-standing integrated exterior mockups.
- C. Build integrated exterior mockups using installers and construction methods that will be used in completed construction.
- D. Use specified products that have been approved by the Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in integrated exterior mockups.
- E. The Work of integrated exterior mockups includes, but is not limited to, the following:
 - 1. Masonry veneer.
 - 2. Cold-formed metal framing and sheathing.
 - 3. Air and weather barriers.
 - 4. Thermal insulation.
 - 5. Through-wall flashing.
 - 6. Flashing and sheet metal trim.

7. Joint sealants.
8. Metal wall panels.
9. Fiber cement wall panels.
10. Aluminum-framed entrances and storefront.
11. Vinyl windows.
12. Glazing.

F. Photographic Documentation: Document construction of integrated exterior mockups with photographs in accordance with Section 013233 "Photographic Documentation." Provide photographs showing details of interface of different materials and assemblies.

1. Document testing procedures, including water leakage and other deficiencies. Photograph modifications to component interfaces intended to correct deficiencies.

G. Provide and document modifications to construction details and interfaces between components and systems required to properly sequence the Work, or to pass performance testing requirements. Obtain Architect's approval for modifications.

H. Retain approved mockups constructed in place. Incorporate fully into the Work.

2.4 ROOM MOCKUPS

A. Build room mockups according to approved mockup Shop Drawings to evaluate constructability, demonstrate the coordination of trades and sequencing of Work, and to demonstrate aesthetic requirements. Include each visible finish, component, and equipment item within room mockups; include operable lighting.

B. Provide room mockups of the following rooms:

1. Residential apartment unit.

C. The Work of room mockups includes, but is not limited to, the following:

1. Millwork and casework.
2. Doors and frames.
3. Access doors and frames.
4. Glazing.
5. Metal framing.
6. Gypsum board.
7. Ceramic tiling.
8. Acoustical ceilings.
9. Resilient flooring.
10. Painting.
11. Plumbing fixtures
12. Registers and grilles.
13. Wiring devices.
14. Lighting.

PART 3 - EXECUTION

END OF SECTION

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 USE CHARGES

- A. Installation and removal of temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Services:
 - 1. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
 - 2. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- C. Electric Power Service:
 - 1. Pay electric-power-service use charges for electricity used by all entities for construction operations for service tied into existing campus facilities.
 - 2. Power available is 120/208V.

1.3 INFORMATIONAL SUBMITTALS

- A. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.
- B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, timesteps, graphic elements, and message content.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program. Refer to Section 013516 "Alteration Project Procedures."
- D. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
 - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
 - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
 - 3. Indicate methods to be used to avoid trapping water in finished work.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.
 - 1. Green or Black Mesh Safety Fabric: "Sand tight" woven fabric with ties for installation onto Chain-Link Fencing.

2.2 TEMPORARY FACILITIES

- A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.

3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.
- E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
 1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 1. Install electric power service underground unless otherwise indicated.

- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install WiFi cell phone access equipment for each field office with coverage extending through majority of active project.
 - 1. At each office, and on each floor of each building in the Project, in a prominent position, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.
 - f. Engineers' offices.
 - g. Owner's office.
 - h. Principal subcontractors' field and home offices.
- I. Electronic Communication Service: Provide secure Wi-Fi wireless connection to internet with provisions for access by Architect and Owner.

3.3 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
 - 1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings, subject to approval of Architect.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Provide parking areas for construction personnel.
- E. Storage and Staging: Use designated areas of Project site for storage and staging needs.
- F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
- G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touch up signs, so they are legible at all times.
- H. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- J. Temporary Elevator Use: See Division 14 elevator Section for temporary use of new elevators.
- K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.
- 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION
- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Erosion and Sedimentation Control: Comply with requirements of Section 015713 "Temporary Erosion and Sedimentation Control."
1. Keep City storm drainage systems around the Work site clear of soil from the Work site. Comply with specifics in Division 01 Sections Summary and Closeout Procedures, including flushing the system out at the completion of the Project.
- D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial

Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

- E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- H. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241 and requirements of Section 013591 "Historic Treatment Procedures." Manage fire-prevention program.
 - 1. Comply with the Owner's Hot Work Permit Program administered by the Facilities Services Department.
 - 2. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 - 3. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
 - 4. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 5. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.

- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.
 - 4. Discard or replace water-damaged material.
 - 5. Do not install material that is wet.
 - 6. Discard and replace stored or installed material that begins to grow mold.
 - 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017413 Progress and Final Cleaning."

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for Contractor requirements related to Owner-furnished products.

1.2 DEFINITIONS

- A. Products: Items obtained 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. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, 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. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that

does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."
- F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 - 1. Resolution of Compatibility Disputes between Multiple Contractors:
 - a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
 - 3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
 - b. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

3. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
 - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of an unnamed product is not considered a substitution if the product complies with requirements.
4. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
5. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of products of an unnamed manufacturer is not considered a substitution if the product complies with requirements.
6. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product match.
 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

- E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
 - 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
 - 1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
 - 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.
- D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Installation of the Work.
 - 3. Cutting and patching.
 - 4. Starting and adjusting.
 - 5. Protection of installed construction.

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at Project site.
 - 1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
 - a. Contractor's superintendent.
 - b. Trade supervisor responsible for cutting operations.
 - c. Trade supervisor(s) responsible for patching of each type of substrate.
 - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.
 - 2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.
- B. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- C. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties' involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
 - 1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.5 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Temporary Support: Provide temporary support of Work to be cut.
- C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface

of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

- a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
- 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.7 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous construction waste.
 - 2. Recycling nonhazardous construction waste.
 - 3. Disposing of nonhazardous construction waste.
- B. Related Information:
 - 1. Section 018113 "Sustainable Design Requirements" for requirements of construction waste management to achieve required Project certification.

1.2 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste become property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

1.5 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
 - 1. Material category: Select two materials to recycle 100 percent.
 - 2. Generation point of waste: Document with photos and record total quantity in volume or weight.
 - 3. Total quantity of waste in tons.
 - 4. Quantity of waste salvaged, both estimated and actual in tons.
 - 5. Quantity of waste recycled, both estimated and actual in tons.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Not required.
- C. Records of Donations: Not required.
- D. Records of Sales: Not required.
- E. Recycling and Processing Facility Records: Optional.
- F. Landfill and Incinerator Disposal Records: Optional.
- G. Submit documentation tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

1.6 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.
- B. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate

quantities by weight or volume but use same units of measure throughout waste management plan.

- B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
 - 1. Total quantity of waste.
 - 2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
 - 3. Total cost of disposal (with no waste management).
 - 4. Revenue from salvaged materials.
 - 5. Revenue from recycled materials.
 - 6. Savings in transportation and tipping fees by donating materials.
 - 7. Savings in transportation and tipping fees that are avoided.
 - 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
 - 9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of **75 percent** by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following.
 - 1. Construction Waste:
 - a. Masonry and CMU.
 - b. Lumber.
 - c. Wood sheet materials.
 - d. Wood trim.
 - e. Metals.
 - f. Roofing.
 - g. Insulation.
 - h. Carpet and pad.

- i. Gypsum board.
- j. Piping.
- k. Electrical conduit.
- l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.
 - 6) Wood crates.
 - 7) Wood pallets.
 - 8) Plastic pails.
- m. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
 - 1) Paper.
 - 2) Aluminum cans.
 - 3) Glass containers.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.3 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - a. Comply with requirements in Section 329300 "Plants" for use of clean ground gypsum board as inorganic soil amendment.

D. Paint: Seal containers and store by type.

3.4 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner's property.
- C. Burning: Do not burn waste materials.
- D. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

END OF SECTION

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.

1.2 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 5. Submit testing, adjusting, and balancing records.
 6. Submit sustainable design submittals not previously submitted.
 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 6. Advise Owner of changeover in utility services.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. 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. 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.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
 1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
 5. Submit Final Completion photographic documentation.
- B. TAB and Commissioning: All TAB work and the commissioning of Division 23 must be complete prior to Final Completion, unless approved in writing by the Owner's Project Manager. Exceptions to this are the planned control system training performed after occupancy and any required seasonal or approved deferred testing. This includes for all systems but is not limited to.
 1. Completed and signed start-up and prefunctional checklist documentation.
 2. Requested trend log data.
 3. Submission of final approved TAB report.
 4. Completion of all functional testing.
 5. Required training of Owner personnel completed and approved.
 6. Submission of the approved O&M manuals.
 7. All identified deficiencies have been corrected or are approved by the Owner to be accepted from this milestone.
- C. Date of Final Completion: The Owner's Project Manager will determine the date of Final Completion after reviewing the Commissioning Agent's recommendation for Final Completion (Functional Completion).
- D. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. 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. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor, listed by room or space number.
 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:

- a. Project name.
- b. Date.
- c. Name of Architect.
- d. Name of Contractor.
- e. Page number.

4. Submit list of incomplete items in the following format:

- a. MS Excel Electronic File: Architect will return annotated file.
- b. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit by uploading to web-based project software site.
- E. Warranties in Paper Form:
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch 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.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.
 - 2. Submit three paper copies. Architect will return two copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Name and contact information for Commissioning Authority.
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.5 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
 - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 - 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 - 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.6 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.
 - 4. Water leak.
 - 5. Power failure.
 - 6. Water outage.
 - 7. System, subsystem, or equipment failure.
 - 8. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

1.7 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information

required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor have delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed and identify color coding where required for identification.

1.8 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.
- 1.9 PRODUCT MAINTENANCE MANUALS
- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.

- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

1.2 INTERIM SUBMITTALS

- A. Record Documents: Submit, with each progress payment application, documentation of current maintenance of Project Record documents indicating changes since the last payment application.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.
2. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints and one set of file prints.
 - 2) Submit Record Digital Data Files and one set(s) of plots.
 - 3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned Record Prints and one set(s) of file prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.

- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

- E. Reports: Submit written report weekly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: 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 provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Format: Annotated PDF electronic file with comment function enabled.

3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications 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. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.
- B. Format: Submit record specifications as annotated PDF electronic file.

1.6 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
- C. Format: Submit Record Product Data as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Product Data.
 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.7 MISCELLANEOUS RECORD SUBMITTALS

- A. 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.
- B. Format: Submit miscellaneous record submittals as PDF electronic file or scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.8 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.

1.2 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.3 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.4 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:

- a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.

- g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

1.5 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.6 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish an instructor to describe Owner's operational philosophy.
 - 2. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, through Architect, with at least seven days' advance notice.
- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

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SECTION 018113 - SUSTAINABLE DESIGN REQUIREMENTS – ENTERPRISE GREEN COMMUNITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements and procedures for compliance with certain 2020 Enterprise Green Communities Criteria and points needed for Project to obtain EGC Certification of new and rehabilitated affordable housing projects.
 - 1. Some EGC points needed to obtain EGC certification depend on product selections and may not be specifically identified as EGC requirements. Compliance with requirements needed to obtain EGC points may be used as one criterion to evaluate substitution requests and comparable product requests.
 - 2. **Checklist:** A copy of EGC Criteria Checklist is attached at the end of this Section.
- B. Some EGC points needed to obtain the indicated EGC certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.
 - 1. Specific requirements for EGC criteria categories are noted in individual sections.
- C. Evaluation of VOCs: Selected building material requirements are included here or integrated into individual specification sections as follows:
 - 1. Requirements to indicate whether building products provided comply with CDPH and CARB or international equivalent.
- D. Related Sections:
 - 1. Section 017419 "Construction Waste Management and Disposal."
 - 2. Section 019113 "General Building Commissioning."
 - 3. Divisions 02 through 33: Sustainable requirements specific to the work of each of these Sections. Requirements may or may not include reference to EGC.

1.2 REFERENCE STANDARDS

- A. General: Comply with the applicable provisions of the referenced standards except as modified by governing codes and the Contract Documents. Where a recommendation or suggestion occurs in the referenced standards, such recommendation or suggestion shall be considered mandatory. In the event of conflict of referenced standards and this specification or within the standards themselves, the more stringent standard or requirement shall govern.
 - 1. CARB SCM: [California Air Resource Board Suggested Control Measure for Architectural Coatings.](#)
 - 2. CDPH: [California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version v1.2-2017."](#)
 - 3. EGC: [Enterprise Green Communities Criteria.](#)
 - 4. EPA TSDA: [Environmental Protection Agency Toxic Substance Control Act Title VI Compliance Rule, 2016.](#)
 - 5. GS-11: [Green Seal Paint Standard GS-11.](#)
 - 6. GS-36: [Green Seal Commercial Adhesive Standard GS-36.](#)
 - 7. SCAQMD 1113: [South Coast Air Quality Management District Rule 1113.](#)

8. SCAQMD 1168: [South Coast Air Quality Management District Rule 1168](#).

1.3 DEFINITIONS

- A. Bio-Based Materials: Not applicable.
- B. Chain-of-Custody Certificates: Not applicable.
- C. Cradle to Cradle: [Product certification](#) assessing material health, material reutilization, renewable energy and carbon management, water stewardship, and social fairness.
- D. Declare Label: A third-party verified product [transparency disclosure format](#) promulgated by the International Living Future Institute (ILFI) that identifies material source, composition, and end-of-life procedures.
- E. Environmental Product Declaration (EPD): A [transparency reporting tool](#) communicating what a product is made of and the environmental impact.
- F. Extended Producer Responsibility: Not applicable.
- G. Health Product Declaration (HPD): [Disclosure of products contents](#) and associated health information.
- H. Manufacturer Inventory: A published, complete content inventory for products.
- I. Product Lens: [Transparency disclosure](#) highlighting hazard information.
- J. REACH Optimization: International standard outlining hazardous substances of high concern to be avoided in material composition.
- K. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
 - 1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.
 - 3. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.
 - 4. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.
 - 5. Provide products with the maximum amount possible of post-consumer and pre-consumer recycled content.
- L. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

- M. WaterSense Label: The WaterSense label from the EPA specifies water efficiency and performance.
- N. Whole-Building Life-Cycle Assessment: Not applicable.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Sustainable Design Coordination Conference: Schedule a sustainable design coordination conference before starting construction, at a time convenient to Owner, Architect, and Commissioning Agent.
 - 1. Agenda: Discuss items of significance that could affect complying with requirements for sustainable design certification, including the following:
 - a. Sustainable Design Project Checklist.
 - b. General requirements for sustainable design-related procurement and documentation.
 - c. Project closeout requirements and sustainable design certification procedures.
 - d. Role of Contractor's sustainable design coordinator.
 - e. Construction waste management.
 - f. Construction operations and sustainable design requirements and restrictions.

1.5 ACTION SUBMITTALS

- A. General: Submit additional sustainable design submittals required by other Specification Sections.
- B. Sustainable design submittals are in addition to other submittals.
 - 1. If submitted item is identical to that submitted to comply with other requirements, include an additional copy with other submittal as a record copy of compliance with indicated sustainable design requirements instead of separate sustainable design submittal. Mark additional copy "Sustainable design submittal."
- C. Sustainable Design Documentation Submittals:
 - 1. Criterion 6.1 Ingredient Transparency for Material Health: Third party verified Declare or HPD documentation for selected product categories.
 - 2. Criterion 6.2 Recycled Content and Ingredient Transparency: Product Data for recycled content indicating postconsumer and preconsumer recycled content and cost.
 - 3. Criterion 6.3 Chemical Hazard Optimization: Product data and third party laboratory test reports for listed products.
 - 4. Criterion 6.4 Healthier Material Selection: Product data and laboratory test reports for interior products indicating VOC content of each product used.
 - 5. Criterion 6.5 Environmentally Responsible Material Selection: Publicly disclosed EPD and supporting documentation for applicable products.
 - 6. Criterion 6.6 Bath, Kitchen, Laundry Surfaces: Product data for mold and moisture resistant gypsum board and precatalyzed epoxy paint products.
 - 7. Criterion 6.7 Regional Materials: Product Data for regional materials indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and weight or cost proportion for each category of regional material.
 - 8. Criterion 6.8 Managing Moisture: Foundations: Product data for under-slab vapor retarder sheets and dampproofing products.

9. Criterion 6.10: Comply with Section 017419 "Construction Waste Management and Disposal."
10. Construction Indoor Air Quality (IAQ) Management:
 - a. Product data for temporary filtration media.
 - b. Product data for filtration media used during occupancy.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Contractor's sustainable design coordinator.
- B. Sustainable Design Action Plans: Provide preliminary submittals within 30 days of date of Notice to Proceed indicating how the specified EGC Criteria categories will be met.
- C. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project related to EGC Criteria. Costs exclude labor, overhead, and profit.

1.7 CLOSEOUT SUBMITTALS

- A. Assemble sustainable design submittals into one package submitted in electronic format at Project completion. Include one consolidated electronic (Excel) copy of the Green Building Materials Form, MR Inputs page and IEQ page, as well as electronic copies of Product Cut Sheets, MSDS, Vendor letters, Vendor invoices, and other required information. Organize documentation by sustainable design category.
- B. Prepare final documentation required by Section 017419 "Construction Waste Management."

1.8 QUALITY ASSURANCE

- A. Contractor's Sustainable Design Coordinator: Engage an experienced professional with successful coordination record on minimum of three projects to coordinate sustainable design requirements. Sustainable design coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Provide products and procedures necessary satisfy sustainable design requirements indicated as Contractor's responsibility. Although other Sections may specify some requirements that contribute to satisfying sustainable design requirements, Contractor provides additional materials and procedures necessary to satisfy sustainable design requirements indicated.

2.2 PRODUCT INGREDIENT TRANSPARENCY

- A. Refer to EGC Checklist for applicable criteria and points.
- B. Provide number of products required that have Declare Label or HPDs from at least three different product categories.
- C. Provide number of products required that have Declare Label or HPDs from at least three different product categories from in any of these categories: adhesives, sealants, windows.
- D. Provide number of products required that have third-party verified Declare Label or third-party verified HPDs from at least three different product categories.

- E. Provide number of products required that have third-party verified Declare Label or third-party verified HPDs from at least three different product categories from in any of these categories: adhesives, sealants, windows.

2.3 RESPONSIBLY SOURCED MATERIALS

- A. Refer to EGC Checklist for applicable criteria and points.
- B. Recycled Content and Ingredient Transparency: Building materials shall have disclosed recycled content. The building product must make up 75 percent by weight or cost of a project category for the project and be composed of at least 25 percent post-consumer recycled content.
- C. Chemical Hazard Optimization: Provide number of products required that have screening level optimization for 100 percent of content to 100 ppm, verified by EGC-listed third party.
- D. Chemical Hazard Optimization: Provide number of products required that have assessment level optimization for 100 percent of content to 100 ppm, verified by EGC-listed third party.
- E. Chemicals of Concern: In addition to Low-Emitting Materials VOC limits below, comply with LBC limitations and EGC-listed limitations on chemicals of concern as detailed in EGC Product Selection Resources.
- F. Environmentally Responsible Material Selection: Select from the following. Refer to EGC Criteria for specifics:
 - 1. Concrete with a publicly disclosed EPD.
 - 2. Steel with a publicly disclosed EPD.
 - 3. Insulation with a publicly disclosed EPD.
 - 4. Green or cool roof.
 - 5. Reflective paving.
 - 6. FSC certified wood.
- G. Regionally Sourced: Materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site, for a minimum of 90 percent by weight or cost from the following categories:
 - 1. Framing.
 - 2. Cladding: siding, roofing, masonry
 - 3. Flooring.
 - 4. Concrete.
 - 5. Gypsum board.
 - 6. Other natural building materials approved by HUD or USDA.

2.4 LOW-EMITTING MATERIALS

- A. Adhesives and Sealants: For field applications of field-applied adhesives, adhesive bonding primers, and adhesive primers that are inside the weatherproofing system, including flooring adhesive, 75 percent of adhesives and sealants meet the VOC emissions evaluation and 100 percent meet the VOC content evaluations.
 - 1. VOC Content: For field applications that are inside the weatherproofing system, provide product data stating TVOC content in grams per Liter (d/L) that comply with VOC content limits of SCAQMD 1168.

- B. Paints and Coatings: For field applications that are inside the weatherproofing system, 75 percent of paints, coatings, and primers meet the VOC emissions evaluation and 100 percent meet the VOC content evaluations.
 1. **VOC Content:** For field applications that are inside the weatherproofing system, provide product data stating TVOC content in grams per Liter (d/L) that comply with VOC content limits of CARB SCM or SCAQMD 1113.
 2. Added Methylene chloride and perchloroethylene is not permitted.
 - C. Composite Wood: A minimum of 75 percent of all composite wood meet the formaldehyde emissions evaluation or salvaged and reused materials criteria. Composite wood materials include particleboard, MDF, hardwood veneer plywood, and structural composite wood.
 1. Provide product data stating compliance with CARB ATCM or EPA TSCA.
 - D. Flooring: A minimum of 90 percent of flooring products meet the VOC emissions evaluation or inherently non-emitting sources criteria or salvaged and reused materials criteria. Subflooring is included under Wood.
 1. **VOC Content:** Provide product data stating TVOC content in grams per Liter (d/L) that comply with VOC content limits of CDPH and specified VOC content limits.
 - E. Walls: A minimum of 75 percent of wall panel products meet the VOC emissions evaluation or inherently non-emitting sources criteria or salvaged and reused materials criteria. Wall panel products include wall paneling, wall coverings, wall tile, surface wall structures, cubicle/curtain/partition walls, trim, doors, frames, windows, and window treatments. Removable/interchangeable fabric panels, built-in cabinetry, and vertical structural elements are excluded.
 1. **VOC Content:** Provide product data stating TVOC content in grams per Liter (d/L) that comply with VOC content limits of CDPH and specified VOC content limits.
 - F. Ceilings: A minimum of 90 percent of ceilings meet the VOC emissions evaluation or inherently non-emitting sources criteria or salvaged and reused materials criteria. Ceiling products include ceiling panels, ceiling tile, surface ceiling structures, suspended systems, and glazed skylights. Overhead structural elements are excluded.
 1. **VOC Content:** Provide product data stating TVOC content in grams per Liter (d/L) that comply with VOC content limits of CDPH and specified VOC content limits.
 - G. Insulation: A minimum of 75 percent of insulation products meet the VOC emissions evaluation. Insulation products include all thermal and acoustic boards, batts, rolls, blankets, sound attenuation fire blankets, and foamed-in-place, loose-fill, blown, and sprayed insulation. HVAC duct and plumbing piping insulation are excluded.
 1. **VOC Content:** Provide product data stating TVOC content in grams per Liter (d/L) that comply with VOC content limits of CDPH and specified VOC content limits.
- 2.5 ADHESIVES AND SEALANTS VOC LIMITS (SCAQMD 1168 g/L)
- A. Architectural Adhesives:
 1. Building Envelope Membrane Adhesive 250
 2. Indoor carpet adhesive 50

3. Carpet Pad Adhesive 50
4. Wood Flooring Adhesive 100
5. Rubber Floor Adhesive 60
6. Subfloor adhesive 50
7. Ceramic Tile Adhesive 65
8. VCT and asphalt tile adhesive 50
9. Drywall and panel adhesive 50
10. Cove base adhesive 50
11. Multipurpose construction adhesive 70
12. Structural glazing adhesive 100

B. Specialty Adhesives:

1. PVC welding 510
2. CPVC welding 490
3. ABS welding 325
4. All other plastic welding cements 250
5. Adhesive primer for plastic 550
6. Contact Adhesive 80
7. Special Purpose Contact Adhesive 250
8. Adhesive Primer for Traffic Marking Tape 150
9. Structural Wood Member Adhesive 140
10. Top and trim adhesive 250

C. Substrate Specific Adhesives:

1. Metal to metal 30
2. Plastic foams 50
3. Porous material (except wood) 50
4. Wood 30
5. Fiberglass 80
6. Reinforced Plastic Composite 250

D. Other Adhesives

1. Other adhesives 250
2. Adhesive bonding primers 250
3. Adhesive primers, or any other primers 250

E. Sealants:

1. Clear, Paintable, and Water-Resistant Sealant 280
2. Foam insulation and sealant 250
3. Grout Sealant 65
4. Non-Staining Plumbing Putty 150
5. Potable Water Sealant 100
6. Single Ply Roof Membrane Sealants 450
7. Other Roof Sealants 300
8. All other Architectural Sealants 250
9. All other Sealants 420

F. Sealant Primers:

1. Architectural - Nonporous 250

2. Architectural- Porous 775
3. Modified Bituminous 500
4. Other 750

2.6 PAINTS AND COATINGS VOC LIMITS (CARB SCM or SCAQMD 1113 g/L)

A. Architectural Paints

1. Flat 50
2. Non-Flat 100
3. Non-Flat High Gloss Coatings 150

B. Coatings:

1. Concrete/Masonry Sealers 100
2. Fire resistive Coatings 350
3. Floor coatings 100
4. Low-Solids Coatings 120
5. Primers, Sealers, and Undercoaters 100
6. Rust Preventative Coatings 250
7. Wood Coatings 275
8. Clear Wood Finish:
9. Varnish 275
10. Sanding Sealers 275
11. Lacquer 275
12. Concrete-Curing Compounds 100
13. Dry Fog Coatings 50
14. Floor Coatings 50
15. Low-solids Coatings 120
16. Magnesite Cement Coatings 450
17. Primers, Sealers and Undercoaters 100
18. Shellac
19. Clear 730
20. Pigmented 550
21. Stains 100
22. Waterproofing Sealers 100
23. Waterproofing Concrete/Masonry Sealers 100
24. Wood Preservatives 350

PART 3 - EXECUTION

3.1 NONSMOKING BUILDING

- A. Smoking is not permitted inside or within 25 feet of a residence.

3.2 CONSTRUCTION WASTE MANAGEMENT

- A. Comply with Section 017419 "Construction Waste Management and Disposal."

3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

- A. Comply with SMACNA's "SMACNA IAQ Guideline for Occupied Buildings under Construction 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3."

1. If Owner authorizes use of permanent heating, cooling, and ventilating systems during construction period as specified in Section 015000 "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.
2. Replace all air filters immediately prior to occupancy.

END OF SECTION

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SECTION 033000 – CAST IN PLACE CONCRETE**PART 1 – GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Scope: The work to be done under this section of the specifications includes all labor, materials, equipment, and services necessary for cast-in-place concrete including formwork, reinforcing, mix design, placement procedures, finishes, as indicated on drawings and herein specified.

1.3 CAST-IN-PLACE CONCRETE: Includes the following:

- A. Foundations and footings.
- B. Slabs-on-grade.
- C. Columns, Girders, Beams and Elevated Slabs.
- D. Foundation walls.
- E. Equipment pads and bases.
 - 1. Include all concrete pads and supports for mechanical and electrical equipment where indicated. Unless otherwise shown, these pads shall include concrete of the size required to support the equipment purchased and 500 lbs. of reinforcing steel per cubic yard of concrete.

1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.
- C. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315R "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures. Reproductions made from contract documents will not be allowed. Submit one (1) electronic print for review and comment. The Engineer will have up to ten (10) working days from the time of receipt of the submittal to complete his review and return the submittal to the Architect. Review of shop drawings by the Architect/Engineer will be for general compliance with contract documents. No responsibility will be assumed for correctness of dimensions, and quantities.
- D. Samples of materials as requested by Architect, including names, sources, and descriptions.
- E. Laboratory test reports for concrete materials and mix design test.
- F. Material certificates in lieu of material laboratory test reports when permitted by Architect. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 - 1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete."

2. ACI 318, "Building Code Requirements for Structural Concrete," current edition.
 3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice," current edition.
- B. Concrete Testing Service: The Owner will employ a testing agency to perform material evaluation tests and to review concrete mix designs for compliance with the Contract Documents.
1. The testing lab shall be in compliance with ASTM E 329 "Standard Specification for Agencies Engaged in Construction Inspection and/or Testing" and ASTM C 1077 "Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation".
 2. The testing laboratory shall submit a certificate of accreditation and the scope of accreditation that indicates compliance with the above standards.
- C. Materials and installed work may require testing and retesting at any time during progress of Work. Retesting of rejected materials for installed Work shall be done at Contractor's expense.

PART 2 – PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/l volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- D. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60.
- B. Steel Wire: ASTM A1064, plain, cold-drawn steel.
- C. Welded Wire Fabric: ASTM A 1064, welded steel wire fabric. Flat sheets only. Rolls are not permitted.
- D. Deformed-Steel Welded Wire Fabric: ASTM A1064.
- E. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.
1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1).
- F. Fiber Reinforcement for exposed structural for exposed structural slab: Fibermesh 150 by Sika or approved equal. Refer to Drawing and Manufacturer's written instructions for application to mixes.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II.
1. Use one brand of cement throughout Project unless otherwise acceptable to Architect.

- B. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.
 - 1. For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.
 - 2. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.
- C. Lightweight Aggregates: ASTM C 330.
- D. Water: Potable.
- E. Admixtures, General: Provide concrete admixtures that contain no more than 0.1 percent chloride ions.
- F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- G. Water-Reducing Admixture: ASTM C 494, Type A.
- H. High-Range Water-Reducing Admixture: ASTM C 494, Type approved by Architect.
- I. Water-Reducing, Accelerating Admixture: ASTM C 494, Type C or E.
- J. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

2.4 RELATED MATERIALS

- A. Vapor Barrier: Vapor barrier shall have all of the following qualities:
 - 1. Maintain permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
 - 2. Other performance criteria:
 - a. Strength: ASTM E1745 Class A.
 - b. Thickness: 15 mils minimum
 - 3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
 - 4. Warranty: (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.
 - 5. Basis of design product shall be “Stego Wrap Vapor Barrier (15-mil)” by Stego Industries LLC. Other approved products include “Vaporguard” by Reef Industries, “PMPC” by WR Meadows.
 - 6. The following accessory products shall be by the approved vapor barrier product manufacturer and as required per manufacturer instructions to achieve the vapor barrier system warranty. Accessory products by manufacturers other than the approved vapor barrier manufacturer are not allowed:
 - a. Seam tape
 - b. Penetration mastic and tape
 - c. Perimeter/terminated edge seal tape and bar
 - d. Penetration prevention products
 - e. Vapor barrier-safe screed system
- B. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- C. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
 - 1. Waterproof paper.
 - 2. Polyethylene film.
 - 3. Polyethylene-coated burlap.
- D. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq. ft./gal.
 - 1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g per liter.

- E. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.
- F. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
- G. Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch thick to feathered edges.
- H. Bonding Agent: Polyvinyl acetate or acrylic base.
- I. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.
- J. Waterstops: Volclay RX-101RH by CETCO or approved equal.

2.5 PROPORTIONING AND DESIGNING MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs. The independent testing agency shall review and approve the proposed mix design.
- B. Submit written reports to Architect of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been submitted to Architect.
- C. Design mixes to provide normal weight concrete or light weight concrete with the 28-day compressive strength as indicated on drawings.
- D. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
 - 1. Not more than 4 inches.
- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

2.6 ADMIXTURES

- A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
- B. Use accelerating admixture in concrete slabs placed at ambient temperatures below 40 deg F (10 deg C) and falling.
- C. **Waterproofing Admixture: Xypex Admix C-500 or Xypex Admix C-1000 as determined by curing conditions on the day of concrete placement, or an approved equal from an alternate product manufacturer. Refer to manufacturer's written instructions and specifications for admixing and placement procedures. Waterproofing admixture shall be added to concrete batches scheduled for placement of slab, walls, and pilasters in the elevator pit.**
- D. Lightweight Structural Concrete:
 - 1. Comply with the requirements of ACI 301, Section 7.
 - 2. Provide concrete with a dry unit weight of not more than 116 pounds per cubic foot and not less than 110 pounds per cubic foot. Design mixture to produce strengths as indicated on the drawings with a split cylinder strength factor ($f_{ct}/(f_c)^{0.5}$) of not less than 5.7.

2.7 CONCRETE MIXING

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

(32 deg C), reduce mixing and delivery time to 60 minutes. Ice can be added to concrete so that delivery time can remain at 1-1/2 hours.

PART 3 – EXECUTION

3.1 GENERAL

- A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing steel.

3.2 FORMS

- A. General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 117 and ACI 347 limits:
 - 1. Provide Class A tolerances for concrete surfaces exposed to view.
 - 2. Provide Class C tolerances for other concrete surfaces.
- B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.
- C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.
- D. Formwork for Grade Beams and Pile Caps: Provide vertical formwork at the perimeter of grade beams and pile caps. Contractor shall install formwork as described here-in to ensure plumbness of cast vertical surfaces.
- E. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- F. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.3 VAPOR RETARDER/BARRIER INSTALLATION

- A. Install vapor barrier in accordance ASTM E1643.
 - 1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 - 2. Vapor barrier shall be neatly placed. Follow the profile of the bottom of the slab and beams and be in intimate contact with the fill. Stop at impediments such as piles, dowels, and waterstops.

3. If arranging placement of vapor barrier perimeter/edge seals prior to placement of concrete, seal vapor barrier to scheduled wet-cast slab perimeter/edge using Manufacturer's recommended adhesive product designed for this use, and remove dirt, debris, and mud from this adhesive product prior to concrete placement.
4. Seal vapor barrier to footing/grade beam with double sided tape, termination bar, or both.
5. Overlap joints 6 inches and seal with manufacturer's tape.
6. Apply tape to a clean and dry vapor barrier.
7. Seal all penetrations (including pipes) per manufacturer's instructions.
8. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
9. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.
10. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the slab itself using Stego Crete Claw Tape, per manufacturer's instructions.
11. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.

3.4 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.
 1. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Architect.
- D. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
 1. Install only flat sheets. Rolls are not permitted.
- F. Where not specifically detailed on the drawings, support slab top reinforcing bars with continuous #4 reinforcing bars. Slab top reinforcing bars less than 6 feet in length shall have two support bars and slab top reinforcing bars greater than 6 feet in length shall have support bars spaced at no more than 3'-0" o.c. These bars shall be equally spaced along the length of the slab top reinforcing bars.

3.5 JOINTS

- A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.
- B. Provide keyways as indicated on drawings or at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.
- C. Provide waterstops at all construction joints in areas indicated on the drawings.

- D. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.
- E. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- F. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

3.6 INSTALLING EMBEDDED ITEMS

- A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.
- B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.7 PREPARING FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
 - 1. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
 - 2. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. General: Comply with ACI 304R, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
 - 1. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.
- C. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
 - 1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
 - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.
- D. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.
 - 1. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.

2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.
4. Floor Slab Tolerance: Refer to Concrete Floor Finish Measurement and Tolerances specified herein. Floor finish tolerances of floor slabs shall conform to the requirements of the specified finish floor manufacturers, and in accordance with ACI 117 and ASTM E 1155 Standard Method for Determining Floor Flatness and Levelness using the F Number System. Specified Overall Finish floor tolerances shall meet the requirements of "flat" as described in ACI 117, unless a more stringent tolerance is required by a finish floor installation. Specified overall and minimum (SOF_L and MLF_L) levelness tolerances shall apply only to level slabs on ground, or to level suspended slabs that are shored when tested. Refer to flooring specifications for additional concrete substrate flatness and levelness requirements.

E. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

- F. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305.1 and as specified.
1. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

3.9 CONCRETE FLOOR FINISH MEASUREMENT AND TOLERANCES

- A. Testing Procedure: ASTM E 1155.
- B. Tolerance on Floor Elevations: Construction tolerance on absolute floor elevation from the specified elevation as shown on the drawings shall be as specified below, taken from ACI 117:
1. Slab-on-Grade Construction: $\pm 3/4"$.
 2. Top Surfaces of Formed Slabs Measured Prior to Removal of Supporting Shores: $\pm 3/4"$.
 3. Top Surfaces of All Other Slabs: $\pm 3/4"$.
- C. Random Traffic Floor Finish Tolerances:
1. Specified overall values for flatness (SOF_F) and levelness (SOF_L) shall conform to the values listed below for the floor surface classification noted for each slab category noted.
 - a. Conventional:
 - 1) SOF_F: 20.
 - 2) SOF_L: 15.
 - b. Moderately Flat:
 - 1) SOF_F: 25.
 - 2) SOF_L: 20.
 - c. Flat:
 - 1) SOF_F: 35.
 - 2) SOF_L: 25.
 - d. Very Flat:
 - 1) SOF_F: 45.
 - 2) SOF_L: 35.
 2. Minimum local values for flatness (MLF_F) and levelness (MLF_L) shall equal 3/5 of the SOF_F and SOF_L values, respectively, unless noted otherwise. The MLF_F and MLF_L values shall apply to the minimum areas bounded by the column lines and half-column lines, or the minimum areas bounded by the construction and contraction joints, whichever are the smaller areas.
 3. The SOF_L and MFL_L tolerance values shall apply only to level slabs-on-ground or to level, uncambered suspended slabs that are shored such that it cannot deflect from the time the floor is placed to the time it is measured.
 4. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10 feet at any point.
- D. Construction Requirements to Achieve Specified Floor Finish Tolerances:

1. Forms shall be properly leveled, in good condition, and securely anchored including special attention to ends and transitions.
 1. Bearing surfaces for straightedges such as form edges or previously poured slabs shall be kept clean of laitance, sand, gravel, or other foreign elements.
 2. Screeds shall be maintained in good condition with true round rolling wheels and level cutting edges. The use of optical sighting equipment such as lasers is recommended for checking levelness and straightness. The Contractor shall promptly adjust or replace equipment when test results indicate substandard work.
 3. Highway straightedges are recommended for use in lieu of bullfloats for all slab placement and finishing operations. If mineral, non-oxidizing metallic, or metallic floor hardeners are used, the slab shall be wood bullfloated immediately after the straightedge.
- E. Contractor Responsibility for Concrete Floor Finish Requirements: Floor finish requirements shown below (flatness and levelness tolerances) are minimum requirements that apply unless stricter requirements are contained in instructions for installation of applied floor products in which case the Contractor is responsible for attaining the values prescribed by the manufacturer of such products.
- F. Concrete Floor Finish Tolerance for Slab-on-Grade Construction:
1. Concrete Placement: Concrete shall be placed and screeded to predetermined marks set to elevations prescribed on the drawings.
 2. Finish Tolerances of Random Traffic Floor Surfaces:
 - a. Slabs in nonpublic areas, mechanical rooms, surfaces to receive raised computer flooring, surfaces to have thick-set tile or a topping, and parking structures: Conventional.
 - b. Carpeted Areas: Moderately Flat.
 - c. Exposed Slabs in Public Spaces, Slabs to Receive Thin-Set Flooring: Flat.
- G. Concrete Floor Finish Tolerance for Shored, Cast-in-Place Suspended Slab Construction:
1. Concrete Placement: Formwork shall be set and securely braced so that soffits are positioned to allow scheduled concrete member sizes and thicknesses within tolerances specified in ACI 117. Concrete shall be placed and screeded to predetermined marks on the form surface conforming to elevations prescribed on the drawings.
 2. Camber: Formwork camber, as indicated on the drawings, shall be set to provide a uniform, smooth soffit profile in each direction. Minimum slab thickness, as specified on the drawings, shall be maintained throughout the slab surface to a tolerance as specified in ACI 117. Tolerance on camber shall be $\pm 1/4"$. Levelness F-Number tolerances specified below do not apply to areas of the floor where camber or intentional slope is shown.
 3. Finish Tolerances of Random Traffic Floor Surfaces:
 - a. Slabs in Nonpublic Areas, Mechanical Rooms, Surfaces to Receive Raised Computer Flooring, Surfaces to Have Thick-Set Tile or a Topping, and Parking Structures: Conventional.
 - b. Carpeted Areas: Moderately Flat.
 - c. Exposed Slabs in Public Spaces, Slabs to Receive Thin-Set Flooring: Flat.
 - d. Movie or Television studios: Super Flat.
 4. Extra Concrete: The contractor shall include in his bid any additional concrete required to achieve the specified slab surface finish tolerance.
 5. Concrete Placement at Column Bays Supported by Unshored Transfer Girders: Concrete in floor areas supported by unshored transfer girders shall be placed and screeded to predetermined marks placed over the slab conforming to elevations as specified on the drawings. At least the minimum slab thickness, as specified on the drawings, shall be maintained throughout the slab surface. The Contractor shall conform to the F_F values specified above.
- H. Concrete Floor Finish Tolerance – Unshored Steel Deck on Shored or Unshored Steel Beam or Steel Joist Floor Construction:
1. Concrete Placement: Concrete over steel deck shall be placed and screeded level and flat to the tolerance specified below, maintaining at least the minimum slab thickness at all locations as specified on the drawings. The Contractor shall increase the slab thickness as required to compensate for steel deck deflection, and in unshored beam construction, residual beam camber and beam deflection in order to achieve a level and flat floor within specified tolerances.

2. Finish Tolerance of Random Traffic Floor Surfaces:
 - a. Slabs in Nonpublic Areas, Mechanical Rooms, Surfaces to Receive Raised Computer Flooring, Surfaces to Have Thick-Set Tile or a Topping, and Parking Structures: Conventional.
 - b. Carpeted Areas: Moderately Flat.
 - c. Exposed slabs in public spaces, slabs to receive thin-set flooring: Flat.
 - d. Eighty percent (80%) of the final floor surface shall fall within an envelope of 0.75" centered about the mean elevation of all the readings. The mean elevation of all readings shall not deviate from the specified design grade by more than ± 0.375 ".
 3. Extra Concrete: The Contractor shall include in his bid any additional concrete required to achieve the specified slab surface finish tolerance and to compensate for steel deck deflection, beam camber and beam deflection.
 4. Concrete Placement at Column Bays Supported on Transfer Girders or Trusses: Concrete in floor areas supported by transfer girders or trusses shall be placed and screeded to predetermined marks placed over the steel deck slab conforming to elevations as specified on the drawings. At least the minimum slab thickness, as specified on the drawings, shall be maintained throughout the slab surface. The Contractor shall conform to the F_F values specified above.
- I. Remedial Measures for Slab Finish Construction Not Meeting Specified Tolerances:
1. Application of Remedial Measures. Remedial measures specified herein are required whenever either or both of the following occur:
 - a. The composite overall values of F_F or F_L of the entire floor installation measure less than specified values.
 - b. Any individual test section measures less than the specified absolute minimum F_F or F_L value.
 2. Modification of Existing Surface:
 - a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work can be repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately undertake the approved repair method.
 - b. The Contractor shall submit for review and approval a detailed work plan of the proposed repair showing areas to be repaired, method of repair, and time to affect the repair.
 - c. Repair method(s), at the sole discretion of the Architect/Engineer or Owner's Representative, may include grinding (floor stoning), planing, retopping with self-leveling underlayment compound or repair topping, or any combination of the above.
 - d. The Architect/Engineer or Owner's Representative maintains the right to require a test repair section using the approved method of repair for review and approval to demonstrate a satisfactory end product. If, in the opinion of the Architect/Engineer or Owner's Representative, the repair is not satisfactory an alternate method of repair shall be submitted or the defective area shall be replaced.
 - e. The judgment of the Architect/Engineer or Owner's Representative on the appropriateness of a repair method and its ability to achieve the desired end product shall be final.
 - f. All repair work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.
 3. Removal and Replacement:
 - a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work cannot be satisfactorily repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately commence to remove and replace the defective work.
 - b. Replacement section boundaries shall be made to coincide with the test section boundaries as previously defined.
 - c. Sections requiring replacement shall be removed by sawcutting along the section boundary lines to provide a neat clean joint between new replacement floor and existing floor.
 - d. The new section shall be reinforced the same as the removed section and doweled into the existing floor as required by the Engineer. No existing removed reinforcing steel may be used. All reinforcing steel shall be new steel.

- e. Replacement sections may be retested for compliance at the discretion of the Architect/Engineer or Owner's Representative.
- f. The judgment of the Architect/Engineer or Owner's Representative on the need for replacement shall be final.
- g. All replacement work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces to be exposed to view, covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections. These projections shall be completely removed and smoothed. Repair all other surface defects in accordance with Concrete Surface Repairs, as specified herein.
- 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.

3.11 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and where indicated.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.
 1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- C. Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.
 1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance.
- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.
- E. Nonslip Broom Finish: Apply a nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.13 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive old or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
 - 1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- B. Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.
 - 1. Provide moisture curing by the following methods:
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Use continuous water-fog spray.
 - c. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.
 - 2. Provide moisture-retaining cover curing as follows:
 - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Apply curing compound on exposed interior slabs and on exterior slabs, walks, and Curb as follows:
 - a. Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
- C. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
- D. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.
 - 1. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.14 REMOVING FORMS

- A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10

deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Comply with ACI 301-10, Chapter 2, Article 2.3.3 – Reshoring and Backshoring.

3.15 REUSING FORMS

- A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable.

3.16 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Architect.
- B. Mix dry-pack mortar, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.
 - 1. Cut out honeycombs, rock pockets, voids, and holes left by tie rods and bolts down to Solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
 - 2. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
 - 1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
 - 1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
 - 2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
 - 3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Architect.
 - 4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen

concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. General: The Owner will employ a testing agency to perform tests and to submit test reports.
- B. Sampling and testing for quality control during concrete placement shall include the following, as directed by Architect.
 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 2. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
 3. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
 5. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
 6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
 7. Field testing the concrete density by ASTM C138.
- C. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
- D. Test results will be reported in writing to Architect, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, slump, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- F. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION

SECTION 033543 – CONCRETE FLOOR SLAB FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sealing of concrete slabs not scheduled for polishing.

B. Related Requirements:

1. Section 033000 "Cast-In-Place Concrete."

1.2 DEFINITIONS

- A. Sealed Concrete: Burnish troweled unpolished concrete floor slabs to be sealed and left exposed. Sealer is specified in this Section or is referenced from the section text.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product specified including floor protection board.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Samples for Verification: For each type of exposed color.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For concrete floors to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Sealer: 1 gal. of each material applied.
 2. Cleaner: 1 gal. of each material applied.

1.7 QUALITY ASSURANCE

- A. Concrete Slab Treatment Products Manufacturer Qualifications: Original product manufacturer experienced in production of concrete slab treatment products, with a qualified technical representative available to support quality assurance requirements of Project.
- B. Installer Qualifications: Engage an experienced firm, approved by manufacturer of primary products, that has successfully completed not less than five projects similar in design, products,

and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.

1.8 COORDINATION

- A. Coordinate floor slab mix design recommendations of floor treatment manufacturer with concrete installer and ready-mix supplier.
- B. Coordinate floor slab placement and finishing procedure recommendations of floor treatment manufacturer with concrete installer and ready-mix supplier.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Provide sealed concrete floors that have been treated to achieve the following:
 - 1. Dynamic Coefficient of Friction (DCOF): Not less than 0.40 for level floor surfaces as determined by a certified NFSI walkway auditor in accordance with ANSI/NFSI B101.

2.2 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Field applied interior paints and coatings.
 - 2. Low-Emitting Materials: Flooring.
 - 3. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.3 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatments for Concrete Finish: Clear, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for sealing concrete surfaces.
 - 1. Available Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. Advanced Floor Products - Curecrete Distribution, Inc; Ashford Formula;
 - b. Advanced Floor Products; Retro Plate 99
 - c. Euclid Chemical Company; Euco Diamond Hard.
 - d. Laticrete International, Inc; L&M Seal Hard
 - e. PROSOCO, Inc; Consolideck LS (for new); Consolideck LSCS (for existing); Consolideck PolishGuard sealer
- B. Source Limitations for Concrete Slab Treatment Products: Provide liquid treatment products including penetrating liquid densifier and sealer, and cleaners provided by or approved by the manufacturer of penetrating liquid densifier floor treatment.
- C. Joint Filler: Manufacturer's recommended semi-rigid, 2-component, self-leveling, 100 percent solids, rapid curing, UV-resistant, non-yellowing polyurea control joint and crack filler with Shore A 80 or higher hardness.

1. Metzger/McGuire Spal-Pro RS 88 Semi-Rigid Polyurea Joint Filler.
2. Metzger/McGuire MM-80□/MM-80P Semi-Rigid Polyurea Joint Filler.
3. Metzger/McGuire Rapid Refloor.

2.4 ACCESSORIES

- A. Cleaning Solution: Manufacturer's recommended pH neutral, concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, and environmentally safe.
- B. Patching Compound: Cementitious compound recommended by manufacturer for patching of small holes in polished concrete floor slab applications. Select product based upon acceptable visual match to adjacent concrete.

PART 3 - EXECUTION

3.1 FINISHING FLOORS AND SLABS

- A. General: Comply with requirements of Section 033000 "Cast-In-Place Concrete" for screeding and finishing operations for concrete surfaces. Do not wet concrete surfaces during finishing.

3.2 PREPARATION OF CONCRETE FLOORS

- A. Preparation of Floors: Clean concrete slab thoroughly to remove sealers, paints, wax, coatings, floor coverings and their mastics, as well as any surface contaminants such as oil or food spills. Rout and clean non-moving cracks and saw cut control joints.

3.3 SEALING OF CONCRETE FLOOR NOT RECEIVING POLISHING

- A. Apply penetrating sealer as soon as cured concrete meets conditions recommended by sealer manufacturer.
- B. Prepare concrete floor in accordance with sealer manufacturer's written instructions. Clean surface and remove deleterious material. Prepare to concrete surface profile required.
- C. Reduce sealer or apply primer coat when recommended by sealer manufacturer.
- D. Apply first topcoat at rate recommended for application, but not less than 130 sq. ft. per gallon for first coat.
- E. Prior to turnover to Owner, clean sealed concrete and apply second topcoat with manufacturer's recommended anti-slip additive at not less than 130 sq. ft. per gallon and sufficient to provide uniform sheen across surface.

END OF SECTION

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SECTION 042613 - MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brick.
2. Mortar materials.
3. Ties and anchors.
4. Embedded flashing.
5. Accessories.
6. Mortar mixes.

B. Products Installed but not Furnished under This Section:

1. Miscellaneous steel for support in locations indicated. Refer to Section 055000 "Metal Fabrications."

C. Related Requirements:

1. Section 076200 "Sheet Metal Flashing and Trim" for furnishing manufactured reglets installed in masonry joints.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

C. Shop Drawings: For the following:

1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

D. Coordination Drawings: For the following:

1. Indicate conditions at relieving angels, brick ties to backup materials, lintels, air/water barriers, penetrations, and transitions to adjacent systems.
2. Show integration with air barrier, flashings, and other enclosure elements.

E. Samples for Verification: For each type and color of the following:

1. Clay face brick, in the form of straps of five or more bricks.
2. Weep/cavity vents.
3. Cavity drainage material.
4. Accessories embedded in masonry.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Statement: For Contractor-retained testing agency.
- B. Qualification Statement for Masonry Installer Firm: Submit list of minimum of five similar projects, including description of project size and scope, and name and contact information for architect, for Installer, superintendent, and crew chiefs. Indicate total years of experience for each.
- C. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
 - 2. Cementitious materials. Include name of manufacturer, brand name, and type.
 - 3. Mortar admixtures.
 - 4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 5. Anchors, ties, and metal accessories.
- D. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
- E. Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.
- F. Brick manufacturer's written instructions for cleaning of brick.
- G. Minutes of Pre-installation Conference.

1.5 QUALITY ASSURANCE

- A. Masonry Flashing Installers: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course or equivalent training acceptable to the Architect.
- B. Masonry Installer Firm: A single, experienced firm, or an approved joint venture, specializing in masonry construction with a minimum five-year record of successful completion of projects of similar scope, capable of providing labor and material and performance bonds for its portion of the Work that are acceptable to the Owner. Installer shall perform the work of this Section with its own regular employees.
 - 1. Installer shall have experienced superintendent and crew chiefs on site supervising the work whenever work is in progress.
 - 2. Contractor's Own Forces: Contractor may utilize own forces for work of this Section when Contractor and Contractor's superintendent and crew chiefs meet the above qualifications.
 - 3. Approved Joint Venture: Installer may consist of a joint venture between two or more experienced firms, each meeting the qualifications indicated above.

- C. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.
- D. Wall Mockups: Build in-place mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of typical exterior wall area in size approximately 60 inches long by 48 inches high by full thickness.
 - 2. Build mockups for typical exterior wall in sizes including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
 - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - d. Include metal studs, sheathing, water-resistive barrier, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
 - 3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
 - 4. Protect accepted mockups from the elements with weather-resistant membrane.
 - 5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. All materials are to be new. Deliver, handle, and store masonry units by means that will prevent mechanical damage, staining, and contamination by other materials.
- B. Do not install damaged materials. Promptly remove from the site all materials rejected by the Architect or damaged during transportation, storage, handling, or installation."
- C. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- E. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- F. Preblended Mortar: Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- G. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of veneer, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down face of veneer, and hold cover securely in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Responsible Sourcing: Recycled content.
 - 3. Responsible Sourcing: Regionally sourced.
 - 4. Responsible Sourcing: Recyclable Content.
 - 5. Building Product Disclosure and Optimization Documentation.

2.2 SOURCE LIMITATIONS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work and will be within 20 ft. vertically and horizontally of a walking surface.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, use the equivalent thickness method for masonry units in accordance with ACI 216.1.

2.4 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 - 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 - 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Clay Face Brick: Facing brick complying with ASTM C216.
 - 1. Basis of Design: Face Brick:
 - a. FB-A: Acme Brick Steele Gray Std Modular Smooth.
 - b. FB-B: Acme Brick Marble Gray Std Modular Smooth
 - 2. Grade: SW.
 - 3. Type: FBS.
 - 4. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
 - 5. Size:
 - a. Nominal D x H X W): 4 by 3 by 8 inches
 - b. Actual: 3-5/8 by 2-5/8 by 7-5/8 inches
 - 6. Application: Refer to the Drawings for locations.

2.5 MORTAR MATERIALS

- A. Preblended Dry Mortar Mix: Packaged blend made from portland cement and hydrated lime masonry cement or mortar cement, sand, mortar pigments, water repellents, and admixtures and complying with ASTM C1714/C1714M.

1. Basis of Design: Holcim Mortamix Masonry Cement, Type S Frosty.

- B. Water: Potable.

2.6 TIES AND ANCHORS

- A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.

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

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch-diameter, hot-dip galvanized steel wire.

- D. Adjustable Masonry-Veneer Anchors:

1. Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.1084-inch-thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.187-inch-diameter, hot-dip galvanized-steel wire.
4. Masonry-Veneer Anchors; Double-Pintle Plate for Concrete and CMU: Rib-stiffened, sheet metal anchor section with single screw hole, projecting horizontal leg with slots for vertical legs of double pintle wire tie. Provide with brass expansion bolt and seismic tie, clip, and continuous wire in veneer.

- a. Products: Subject to compliance with requirements, provide [Hohmann & Barnard, Inc.; HB-5213](#) or comparable product of one of the following.

- 1) Heckmann Building Products, Inc.
- 2) Wire-Bond.

5. Masonry-Veneer Anchors; Double-Pintle Plate for Metal Stud Framing: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting horizontal leg with slots for vertical legs of double pintle wire tie.

- a. Products: Subject to compliance with requirements, provide [Hohmann & Barnard, Inc.; HB-213](#) or comparable product of one of the following.

- 1) Heckmann Building Products, Inc.
- 2) Wire-Bond.

6. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours according to ASTM B117.

2.7 EMBEDDED FLASHING

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.023 inch thick.
2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing. Coordinate with Section 076200 "Sheet Metal flashing and Trim" and Section 077100 "Roof Specialties" as applicable to Project.
4. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
5. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
6. Fabricate metal expansion-joint strips in metal flashing from stainless steel.
7. Solder metal items at corners.

- B. Flexible Flashing: Use the following:

1. Stainless Steel Fabric Flashing: Composite, flashing product consisting of 2 mil of Type 304 stainless steel sheet, bonded to a layer of polymeric fabric.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) [Hohmann & Barnard, Inc; Mighty-Flash.](#)
 - 2) [Wire-Bond; BOND-N-FLASH.](#)
 - 3) [York Manufacturing, Inc; York Multi-flash.](#)
2. Self-Adhering, Stainless Steel Fabric Flashing: Composite, flashing product consisting of 2 mil of Type 304 stainless steel sheet, bonded to a layer of polymeric fabric.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) [Hohmann & Barnard, Inc; Mighty-Flash-SA.](#)
 - 2) [Wire-Bond; BOND-N-FLASH SA.](#)
 - 3) [York Manufacturing, Inc; York 304 SA.](#)
3. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 40 mil.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) DuPont de Nemours, Inc.; [DuraGard CM.](#)
 - 2) Protecto Wrap Company; [Protecto Seal 45.](#)
 - 3) Wire-Bond; [Rhino Bond Flashing #4123.](#)

4. Flashing Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- C. Application: Unless otherwise indicated, use the following:
1. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
 2. Where flashing is indicated to receive counterflashing, use metal flashing.
 3. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 4. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge.
 5. Where flashing is fully concealed, use metal flashing or flexible flashing.
- D. Drainage Plane Flashing: Fabricate from stainless steel and drainage membrane to shapes indicated, including weep tabs, termination bar and drip edge. Provide flashing materials as follows:
1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
 2. Fabricate continuous flashings in sections 60 inches long, minimum.
 3. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- E. Solder and Sealants for Sheet Metal Flashings:
1. Solder for Stainless Steel: ASTM B32,, with acid flux of type recommended by stainless steel sheet manufacturer.
 2. Elastomeric Sealant: ASTM C920, chemically curing urethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.
- F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- G. Termination Bars for Flexible Flashing, Flanged: Stainless steel sheet 0.019 inch by 1-1/2 inches with a 3/8-inch flange at top.

2.8 ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.
- B. Weep/Cavity Vent Products: Use the following unless otherwise indicated:
1. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products Inc.; Mortar Break Weep Mesh.
 - 2) CavClear/Archovations, Inc.; CavClear Weep Vents.
 - 3) Mortar Net Solutions; Mortar Net Weep Vents.

- C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Mortar Deflector: Strips, full depth of cavity and 16 inches high, with dovetail-shaped notches or dimpled surface that prevent clogging with mortar droppings.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products Inc.; Mortar Break or Mortar Break DT.
 - 2) Hohmann & Barnard, Inc; Mortar Trap.
 - 3) Mortar Net Solutions; Mortar Net with Insect Barrier or Wall Defender.
 - 4) Wire-Bond; Cavity Net DT.
 - 5) York Manufacturing, Inc; Weep-Net.
 - 2. Rainscreen Drainage Mat: Sheets or strips not less than 1-1/2 inches thick, and installed to full height of cavity, with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity to prevent weep holes from clogging with mortar.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - 1) Advanced Building Products Inc.; Mortairvent CW.
 - 2) CavClear/Archovations, Inc.; Masonry Mat.
 - 3) Mortar Net Solutions; DriPlane.
 - 4) Wire-Bond; Cavity Net II.
- D. Offset Angle Supports: Steel plate brackets anchored to structure, allowing continuous insulation behind shelf angle supporting veneer. Component and anchor size and spacing engineered by manufacturer.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- E. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.9 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Use Type N unless another type is indicated.
 - 1. For masonry below grade or in contact with earth, use Type M or Type S.
 - 2. For exterior, above-grade walls and parapets, use Type S.

- D. Pigmented Mortar: Use colored cement product.
 - 1. Pigments do not exceed 10 percent of portland cement by weight.
 - 2. Mix to match Architect's sample.
 - 3. Application: Use pigmented mortar for exposed mortar joints.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match Architect's sample.
 - 2. Application: Use colored-aggregate mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Masonry Workmanship: Comply with applicable recommendations of the Brick Industry Association (BIA) and The Masonry Society (TMS) except as modified below.
 - 1. Report damage to flashings within the work area to the Architect. Do not proceed with masonry installation until associated waterproofing and flashings are satisfactorily installed.
 - 2. Perform masonry work in a neat and workmanlike manner. Prevent staining surfaces with mortar or other spills. Avoid dropping mortar on completed masonry work or other elements building. If mortar drops or spills, spot-clean immediately using a sponge and clean water.
 - 3. Dry-brush newly completed masonry and exposed flashing surfaces daily to clean and remove set mortar.
- B. Interim Protection: Protect incomplete masonry by well-fastened waterproof coverings. Protect flashings against penetration or other damage. Turn scaffold boards on edge at end of day and protect the base of the wall to prevent rain splashed mud or mortar drippings from contacting masonry.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
 - 1. Coordinate access required for completing air barrier membrane detailing around equipment penetrations.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

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

B. Lines and Levels:

- 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch 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, 1/4 inch in 20 feet, or 1/2-inch maximum.
- 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
- 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
- 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
- 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
- 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

- 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/16 inch, with a maximum thickness limited to 5/16 inch.
- 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
- 3. For head and collar joints, do not vary from thickness indicated by more than plus 1/4 inch or minus 1/4 inch.
- 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/16 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/16 inch.
- 5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 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 on Drawings, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay 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.
- B. Lay CMUs with face shells fully bedded in mortar and with head joints of depth equal to bed joints. At starting course, fully bed entire units, including area under cells.
 - 1. At anchors and ties, fully bed units and fill cells with mortar as needed to fully embed anchors and ties in mortar.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 - 2. Embed tie sections in masonry joints.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
 - 5. Coordinate access required for sealing air barrier membrane penetrations at fasteners and affecting repairs.
- B. Provide not less than 2 inches of airspace between back of masonry veneer and face of sheathing or insulation.
 - 1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete to comply with the following:
 - 1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 EXPANSION JOINTS

- A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form expansion joints as follows:
 - 1. Build in compressible joint fillers where indicated.
 - 2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."
- C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under water-resistive barrier or air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
 - 3. At lintels and shelf angles, extend flashing 6 inches minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum, to edge of next full unit and turn ends up not less than 2 inches to form end dams.

4. Interlock end joints of sawtooth sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 5. Install metal drip edges with sawtooth sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
 7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
 8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are indicated to be built into masonry.
- D. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
1. Use specified weep/cavity vent products to form weep holes.
 2. Space weep holes 24 inches o.c. unless otherwise indicated.
- E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.
- F. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products 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.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.
- B. Inspections: Special inspections in accordance with Level 2 in TMS 402.
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
- C. Testing Prior to Construction: One set of tests.
- D. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.
- E. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than 4 inches in each dimension.
 - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

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SECTION 051200 – STRUCTURAL STEEL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. 013564 – Green Requirement Summary
- C. 013565 – LEED Certification Procedures
- D. 018113 – Sustainable Design Requirements
- E. 055000 – Metal Fabrications: Steel fabrications affecting structural steel work

1.2 SUMMARY

- A. Scope: This Section includes fabrication and erection of structural steel work, as shown on drawings including schedules, notes, and details showing size and location of members, typical connections, and types of steel required.
- B. Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" current edition, and as otherwise shown on drawings.
- C. Miscellaneous Metal Fabrications are specified elsewhere in Division 5.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
 - 1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
 - 2. High-strength bolts (each type), including nuts and washers.
 - 3. Structural steel primer paint.
 - 4. Shrinkage-resistant grout.
- C. Shop drawings, including complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams.
 - 1. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols and show size, length, and type of each weld.
 - 2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.
 - 3. See Section Submittals for shop drawings requirements. Reproductions made from contract drawings will not be accepted. Submit one (1) electronic print for review and comment. The Engineer will have up to ten (10) working days from the time of receipt of the submittal to complete his review and return the submittal to the Architect. Review of shop drawings by the Architect/Engineer will be for general compliance with contract documents. No responsibility will be assumed for correctness of dimensions, quantities or details.
 - 4. Miscellaneous Metal Fabrications are specified elsewhere in Division 5.

5. All shop drawings used in the field must bear the Architect/Engineer shop drawings review stamp with "No Exceptions Taken" indicated.
 6. For connections not scheduled or detailed include stamped calculations and shop drawings prepared under supervision of a Alabama-licensed Structural Engineer.
- D. Mill Test Reports: Submit manufacturer's certified test reports to the testing laboratory and architect showing chemical analysis and results of tensile and bending tests. Tests shall meet the requirements of ASTM A6/A6M.
- E. Test reports conducted on shop and field-bolted and welded connections. Include data on type(s) of tests conducted and test results.
- F. AISC certification documentation for fabricators and erectors.
- G. Sustainable Design Documentation Submittal: As specified in Section 018113.

1.4 QUALITY ASSURANCE

- A. Standard Specifications: Except as modified or supplemented by these specifications, materials, design, fabrication, and erection of Structural Steel shall be in accordance with the American Institute of Steel Construction's "Specifications for Structural Steel for Buildings, Allowable Stress Design and Plastic Design", June 22, 2010, and the A.I.S.C. "Code of Standard Practice for Steel Buildings and Bridges", April 14, 2010. A.I.S.C. Steel Construction Manual, Fourteenth Edition.
- B. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
1. American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges."
 - a. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence: "This approval constitutes the Owner's acceptance of all responsibility for the design adequacy of any detail configuration of connections developed by the fabricator as a part of his preparation of these shop drawings."
 2. AISC "Specifications for Structural Steel Buildings," including "Commentary."
 3. "Specifications for Structural Joints using ASTM F 3125 Bolts" approved by the Research Council on Structural Connections.
 4. American Welding Society (AWS) D1.1 "Structural Welding Code - Steel."
 5. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."
- C. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.
1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
 2. If recertification of welders is required, retesting will be Contractor's responsibility.
- D. Fabricators and Erectors shall be AISC certified.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off-ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. If bolts and nuts become dry or rusty, clean and relubricate before use.

PART 2 – PRODUCTS**2.1 MATERIALS**

- A. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.
- B. Structural Steel.
 - 1. Shapes, except for channels, angles and plate: ASTM A992 Grade 50.
 - 2. Channels, angles and plate: ASTM A 36.
- C. Cold-Formed Steel Tubing: ASTM A 500, Grade B, min. fy = 46 ksi.
- D. Steel Pipe: ASTM A 53, Type E or S, Grade B; or ASTM A 501, min. fy = 35 ksi.
- E. Anchor Bolts: ASTM F 1554, non-headed type unless otherwise indicated.
- F. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low-carbon steel bolts and nuts.
 - 1. Provide hexagonal heads and nuts for all connections.
- G. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows.
- H. Quenched and tempered medium-carbon steel bolts, nuts, and washers, complying with ASTM F 3125.
 - 1. Where indicated as galvanized, provide units that are zinc coated, either mechanically deposited complying with ASTM B 695, Class 50, or hot-dip galvanized complying with ASTM A 153.
- I. Electrodes for Welding: Comply with AWS Code.
 - 1. Welding electrodes for manual shielded metal-arc welding shall conform to AWS A5.1 or A5.5 E70XXX welding electrodes and flux used in submerged arc process shall conform to AWS A5.17 F7X-EXXX. Use low hydrogen electrodes for A572 steel.
- J. Headed Concrete Anchors (H.C.A.): To meet or exceed AWS specification D1.1.
- K. Deformed Bar Anchor (D.B.A.): Manufacture red in accordance with ASTM A 496.
- L. Structural Steel Primer Paint: Rust-inhibitive conforming to Fed. Spec. SSPC 15 and be compatible with finish paint systems.
- M. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean, uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 2.0 parts sand, by volume, with minimum water required for placement and hydration.
- N. Nonmetallic Shrinkage-Resistant Grout: Premixed, nonmetallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621.
- O. Recycled Content: 10% (post-consumer plus ½ pre-consumer).

2.2 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
 - 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
 - 2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
- B. Connections: Weld or bolt shop connections, as indicated.
 - 1. Bolt field connections, except where welded connections or other connections are indicated.
- C. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
- D. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on final shop drawings.
 - 1. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.
 - 2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.3 SHOP PAINTING

- A. General: Shop-paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel that is partially exposed on exposed portions and initial 2 inches of embedded areas only.
 - 1. Do not paint surfaces to be welded or high-strength bolted with friction-type connections.
 - 2. Do not paint surfaces scheduled to receive sprayed-on fireproofing.
 - 3. Apply 2 coats of paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- B. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 1.5 mils. Use painting methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.4 GALVANIZING

- A. Items shown on the plans to be galvanized and bolts for same shall be hot dip zinc coated after fabrications. Galvanizing shall be done in accordance with A.S.T.M. Serial Designation A123 and A153. Any zinc coating that is damaged shall be touched up with Galvacon as manufactured by Southern Coatings in accordance with the manufacturer's recommendations.

2.5 SOURCE QUALITY CONTROL

- A. General: Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

1. Promptly remove and replace materials or fabricated components that do not comply.
- B. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.
 1. Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

PART 3 – EXECUTION

3.1 ERECTION

- A. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary Members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.
- B. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.
- C. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
 1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
 3. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
 4. For proprietary grout materials, comply with manufacturer's instructions.
- D. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure within specified AISC tolerances.
 2. Splice members only where indicated and accepted on shop drawings.
- E. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds, and grind smooth at exposed surfaces.
 1. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 2. Do not enlarge unfair holes in members by burning or by using drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- F. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.
- G. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
 1. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

3.2 QUALITY CONTROL

- A. The Owner will engage an independent testing and inspection agency to inspect high-strength bolted welded connections and to perform tests and prepare test reports.
 1. The testing lab shall be in compliance with ASTM A 880 “Practice for Criteria for Use in Evaluation of Testing Laboratories and Organizations for Examination and Inspection of Steel, Stainless Steel, and Related Alloys”.
 - a. The testing laboratory shall submit a certificate of accreditation, including the scope of accreditation that indicates compliance with the above standards.
 - b. Visual inspection of welds shall be performed by an AWS Certified Welding Inspector (AWS-QC-1).
 - c. The inspection of welds shall be overseen by an AWS Certified Welding Inspector.
 2. Testing agency shall conduct and interpret tests, state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.
 3. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
 4. Testing agency may inspect structural steel at plant before shipment.
- B. Correct deficiencies in structural steel work that inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor’s expense, as necessary to reconfirm any noncompliance of original work and to show compliance of corrected work.
- C. Shop-Bolted Connections: Inspect or test in accordance with AISC specifications. Verify that gaps of installed Direct Tension Indicators are less than gaps specified in ASTM F 959, Table 2.
- D. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:
 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
 2. Perform visual inspection of all welds.
 3. Perform tests on 20% of all full-pen welds as follows: Ultrasonic Inspection: ASTM E 164.
- E. Field-Bolted Connections: Inspect in accordance with AISC specifications.
- F. Field Welding: Inspect and test during erection of structural steel as follows:
 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
 2. Perform visual inspection of all welds.
 3. Perform tests of all (100%) full-pen welds as follows: Ultrasonic Inspection: ASTM E 164.
- G. Testing and Inspection of Headed Concrete Anchors (H.C.A.): The testing lab shall conduct tests and inspections in accordance with AWS D1.1, latest edition, Chapter 7 “Stud Welding”.

END OF SECTION

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel shapes for supporting elevator components, including:
 - a. Sill and guide rail supports
 - b. Hoist beams
 - c. Elevator pit sump covers.
 - d. Elevator pit ladder
2. Slotted channel framing.
3. Metal ladders.
4. Metal bollards.
5. Miscellaneous steel shapes not specified in other Sections.
6. Embedded abrasive stair nosings.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Concealed lintel system.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
2. Section 042613 "Masonry Veneer" for installing loose lintels, anchor bolts, and other items built into unit masonry.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Slotted channel framing.
5. Manufactured metal ladders.

6. Alternating tread devices.
7. Metal ladders.
8. Metal bollards.

- B. **Sustainable Design Submittals:** Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. **Shop Drawings:** Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 1. Steel framing and supports for overhead doors.
 2. Steel framing and supports for mechanical and electrical equipment.
 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 4. Elevator machine beams, hoist beams.
 5. Steel shapes for supporting elevator components, including:
 - a. Sill supports.
 - b. Hoist beams.
 - c. Divider beams.
 - d. Elevator pit sump covers.
 - e. Elevator pit ladder.
 6. Shelf angles.
 7. Metal ladders.
 8. Metal bollards.
 9. Loose steel lintels.
- D. **Samples for Verification:** For each type and finish of extruded nosing.
- E. **Delegated-Design Submittal:** For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. **Design Submittal:** For slotted channel framing, including manufacturers' published load tables annotated to indicate selections required for Project.

1.4 INFORMATIONAL SUBMITTALS

- A. **Qualification Data:** For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

1.5 QUALITY ASSURANCE

- A. **Welding Qualifications:** Qualify procedures and personnel in accordance with the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 FIELD CONDITIONS

- A. **Field Measurements:** Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Responsible Sourcing: Recycled content.
 - 2. Responsible Sourcing: Regionally sourced.
 - 3. Responsible Sourcing: Recyclable Content.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches, unless larger size required by manufacturer's written recommendation for supported item and span.
 - 2. Material: Cold-rolled steel, ASTM A1008/A1008M, commercial steel, Type B; 0.0677-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.

2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless steel fasteners for fastening aluminum and stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- F. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.
- H. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.5 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings."
- B. Universal Shop Primer: For interior items not indicated to receive paint: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

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

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.

- E. Prime miscellaneous framing and supports with primer specified in Section 099600 "High-Performance Coatings" where indicated.

2.8 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
3. Rail and Harness Fall Arrest System: Provide safety device for ladders exceeding 24 feet in total length of climb.

B. Steel Ladders:

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 1-inch-square, steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Source Limitations: Obtain nonslip surfaces from single source from single manufacturer.
6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
7. Prime ladders, including brackets and fasteners, with zinc-rich primer.

2.9 ELEVATOR PIT SUMP COVERS

- A. Fabricate from 3/16-inch abrasive-surface floor plate with four 1-inch-diameter holes for water drainage and for lifting.
- B. Provide steel angle supports unless otherwise indicated.

2.10 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Prime miscellaneous steel trim.
- D. Prime exterior miscellaneous steel trim with primer specified in Section 099600 "High-Performance Coatings."

2.11 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe.
- B. Fabricate bollards with 3/8-inch-thick, steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

- C. Prime steel bollards with primer specified in Section 099600 "High-Performance Coatings."

2.12 LOOSE BEARING AND LEVELING PLATES

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

2.13 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
- C. Galvanize and prime loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with primer specified in Section 099600 "High-Performance Coatings."

2.14 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.15 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.16 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.3 INSTALLATION OF METAL BOLLARDS

- A. Permanently Installed Bollards: Fill bollards solidly with concrete. Set domed bollard caps in place according to manufacturer's written instructions, clean excess concrete fill and allow concrete to cure seven days before installing.
 1. Anchor bollards in concrete in formed or core-drilled holes not less than 42 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

3.4 INSTALLATION OF BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 REPAIRS

- A. Touchup Painting:
 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

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SECTION 055113 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads for interior use.

B. Related Information:

1. Section 055211 "Pipe and Tube Railings, Interior" for standard pipe and tube railings for metal stairs and other applications.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs.

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

- C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

1.3 ACTION SUBMITTALS

A. Product Data: For metal pan stairs and the following:

1. Shop primer products.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.

- C. Delegated-Design Submittal: For stairs, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
 - 1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 - 2. Protect steel members and packaged materials from corrosion and deterioration.
 - 3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
 - a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft.
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.
- C. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.5.

2.2 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.
- D. Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.
 - 1. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2.4 ABRASIVE UNITS

- A. Extruded Units for Concrete Fill Treads: Aluminum units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - 1. Available Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) American Safety Tread Co., Inc.
 - 2) Balco; a CSW Industrials Company.
 - 3) Wooster Products Inc.

2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
3. Nosings, Square-Back Units: 3 inches wide, without lip.
4. Nosings, Two-Piece Units: 3 inches wide, with subchannel for casting into concrete.
5. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
6. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. Shop Primers: Provide primers that comply with Section 099600 "High-Performance Coatings."
- C. Site-Placed Concrete Fill Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
 1. Resilient Stair Treads: Refer to Section 096513 "Resilient Base and Accessories."
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 1. Join components by welding unless otherwise indicated.
 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs in shop to greatest extent possible.
 1. Disassemble units only as necessary for shipping and handling limitations.
 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Weld exposed corners and seams continuously unless otherwise indicated.
 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 - Completely sanded joint with some undercutting and pinholes okay.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
 2. Locate joints where least conspicuous.
 3. Fabricate joints that will be exposed to weather in a manner to exclude water.
 4. Provide weep holes where water may accumulate internally.

2.7 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Commercial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
1. Fabricate stringers of steel plates or steel channels.
 - a. Stringer Size: As required to comply with "Performance Requirements" Article.
 - b. Provide closures for exposed ends of channel and rectangular tube stringers.
 - c. Finish: Shop primed.
 2. Construct platforms of steel plate or channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.
 - a. Provide closures for exposed ends of channel and rectangular tube framing.
 - b. Finish: Shop primed.
 3. Weld stringers to headers; weld framing members to stringers and headers.
 4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below.
 - a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
 5. Where masonry walls support metal stairs, temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.

1. Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.
2. Steel Sheet: Uncoated, hot-rolled steel sheet.
3. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
4. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.
5. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.8 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedment's for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
 1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates.
 - a. Clean bottom surface of plates.

- b. Set plates for structural members on wedges, shims, or setting nuts.
 - c. Tighten anchor bolts after supported members have been positioned and plumbed.
 - d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
 - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
 - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - 2. Comply with requirements for welding in "Fabrication, General" Article.
- F. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.
 - 2. Interior Concrete Treads to Receive Adhered Rubber Treads: Leave concrete in float finish and wet cure; do not use curing compound. I

3.3 REPAIR

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION

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SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel pipe and tube railings.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

D. Samples: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

- a. Show method of connecting and finishing members at intersections.

E. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
 - 1. Responsible Sourcing: Recycled content.

2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 2-1/4-inch clearance from inside face of handrail to finished wall surface.

2.4 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed).
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Provide galvanized finish for exterior installations and where indicated.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.5 FASTENERS

- A. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- B. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Shop Primers: Provide primers that comply with Section 099600 "High-Performance Coatings."
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- J. Close exposed ends of railing members with prefabricated end fittings.
- K. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- N. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.8 STEEL AND IRON FINISHES

- A. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- B. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.
- D. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.
- B. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.

3.6 ADJUSTING AND CLEANING

- A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

3.7 REPAIR

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and re-prime exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION

SECTION 057313 – DECORATIVE METAL RAILINGS, EXTERIOR

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior steel decorative railings.

1.2 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

1.3 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not meet structural performance requirements.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of railings assembled from standard components.
2. Grout, anchoring cement, and paint products.

B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

- C. Shop Drawings: Include plans, elevations, sections, and attachment details.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.

- E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.

1.7 QUALITY ASSURANCE

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

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113:
 - 1. Responsible Sourcing: Recycled content.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Working Stresses: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Stainless Steel: 60 percent of minimum yield strength.
 - 2. Steel: 72 percent of minimum yield strength.
- C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.

2.3 METALS

- A. Metal Surfaces: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

- 1. Provide metal brackets as indicated on Drawings.

2.4 STEEL

- A. Tubing: ASTM A500/A500M (cold formed) or ASTM A513.
- B. Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.
- C. Plates, Shapes, and Bars: ASTM A36/A36M.

2.5 FASTENERS

- A. Fastener Materials: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material For Exterior and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For stainless-steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Shop Primers: Provide primers that comply with Section 099600 "High-Performance Coatings."
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

2.7 FABRICATION

- A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces. Make handrails smooth to the touch.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- I. Form changes in direction as follows:
 - 1. As detailed.
- J. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of hollow railing members with prefabricated end fittings.
- L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.
- M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
- N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

- O. For railing posts set in concrete, provide steel sleeves not less than 4 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.8 FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.9 STEEL AND IRON FINISHES

- A. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 1. Shop-Applied Primer: Pigmented Polyurethane over Epoxy Zinc-Rich Primer specified in Section 099600 "High Performance Coatings."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

- A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.
- C. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with sleeves concealed within railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
- C. Attach handrails to walls with wall brackets except where end flanges are used. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.

3.6 CLEANING

- A. Clean railings by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099600 "High-Performance Coatings."

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION

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SECTION 057500 - DECORATIVE FORMED METAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Closures and trim.
 - 2. Decorative metal panels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Show fabrication and installation details for decorative formed metal.
 - 1. Include plans, elevations, component details, and attachment details.
 - 2. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
- C. Samples: For each type of exposed finish required, prepared on 6-inch- square Samples of metal of same thickness and material indicated for the Work.
- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design metal trellis, including attachment to building construction.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on metal trellis by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METAL

- A. General: Fabricate products from sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
- B. Aluminum Sheet: Flat sheet complying with ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties of not less than Alloy 5005-H32.

2.3 MISCELLANEOUS MATERIALS

- A. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as necessary for strength, corrosion resistance, and compatibility in fabricated items.

- B. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated.
 - 1. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.
- C. Anchors: Provide fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
- D. Anchor Materials:
 - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- E. Isolation Coating: Manufacturer's standard bituminous paint.

2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble decorative formed metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch and support with concealed stiffeners.
- C. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness and sufficient strength for indicated use.
 - 1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
- D. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.

2.5 CLOSURES AND TRIM

- A. Form closures and trim from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction, with weathertight joints at exterior installations.
 - 1. Aluminum Sheet: 0.063 inch.
 - a. Finish: High-performance organic coating.

2.6 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Match Architect's sample.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.
- E. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION

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SECTION 061000 – ROUGH 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. Types of work in this section include rough carpentry for:
 - 1. Wood framing.
- B. Related Sections include:
 - 1. Section 06 “Miscellaneous Rough Carpentry” for requirements for wood framing.
 - 2. Section 062023 “Interior Finish Carpentry” for Interior Trim.
 - 3. Section 061010 – Applied Termiticide Treatment for Rough Carpentry, for spray applied termite treatment for all wood framing and rough carpentry.

1.3 DEFINITIONS

- A. Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated.

1.4 SUBMITTALS

- A. Material Certificates: Where dimensional lumber is provided to comply with minimum allowable unit stresses, submit listing of species and grade selected for each use and submit evidence of compliance with specified requirements. Compliance may be in form of a signed copy of applicable portion of lumber producer’s grading rules showing design values for selected species and grade. Design values shall be approved by the Board of Review of American Lumber Standards Committee.
- B. Wood Treatment Data: Submit chemical treatment manufacturer’s instructions for handling, storing, installation and finishing of treated material.
 - 1. Preservative Treatment: For each type specified or as indicated on the Drawings, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained and conformance with applicable standards.
 - 2. For water-borne treatment include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.

1.5 PRODUCT HANDLING

- A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.

1.6 PROJECT CONDITION

- A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow attachment of other work.
- B. Additional Carpentry Work: If previously undetected damage to existing wood framing is discovered during the course of Work as described in the Contract Documents, additional carpentry work will be required. Refer to the unit cost schedule for this additional work. Actual material quantities determined on-site may vary from the estimated material allowances shown on the drawings.

PART 2 – PRODUCTS

2.1 LUMBER, GENERAL

- A. Lumber Standards: Manufacture lumber to comply with PS 20 "American Softwood Lumber Standard:" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Inspection Agencies: Inspection agencies and the abbreviations used to reference with lumber grades and species include the following:
 - 1. SPIB - Southern Pine Inspection Bureau.
- C. Grade Stamps: Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
- D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
 - 1. Provide dressed lumber, S4S, unless otherwise indicated.
 - 2. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2" or less in nominal thickness, unless otherwise indicated.

2.2 DIMENSION LUMBER

- A. For framing provide the following grade and species.
 - 1. Southern Pine graded under SPIB rules - No. 2 SYP.

2.3 MISCELLANEOUS LUMBER

- A. Provide wood for support or attachment of other work including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown and as follows:
- B. Moisture content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- C. Grade: Standard Grade light framing size lumber of any species or board size lumber as required. No. 3 Common or Standard grade boards per WCLIB or WWPA rules or No. 3 boards per SPIB rules.
- D. Plywood: See drawings.

2.4 MISCELLANEOUS MATERIALS

- A. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails. All fasteners and accessories shall be hot-dipped galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.
- B. Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.
- C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards.

- D. Countersink nail heads on exposed carpentry work and fill holes.
- E. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.2 WOOD GROUNDS, NAILERS, BLOCKING AND SLEEPERS

- A. Provide wherever shown and where required for screeding or attachment of other work. Form to shape as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

3.3 WOOD FRAMING, GENERAL

- A. Provide framing members of sizes and on spacings shown, and frame openings as shown, or if not shown, comply with recommendations of the latest edition of AF&PA's WCD 1, "Details for Conventional Wood Frame Construction". Do not splice structural members between supports.
- B. Fastening: Nails shall be hot-dipped galvanized conforming to ASTM A153 or stainless steel 304 or 316 nails. Aluminum carbon steel nails shall not be used.

END OF SECTION

SECTION 061400 – ENGINEERED LUMBER

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 all laminated veneer lumber (LVL) and parallel strand lumber (PSL) as shown on the drawings.

1.3 QUALITY ASSURANCE

- A. Laminated veneer lumber shall be designed and manufactured to the standards set forth in the Council of American Building Officials (CABO) Report No. NER-126.

1.4 SUBMITTALS

- A. Shop drawings: Complete shop drawings showing the layout and details necessary for determining fit and placement in the structure shall be provided by the manufacturer. Reproductions made from contract drawings will not be allowed. The Engineer will have up to ten (10) working days from the time of receipt of the submittal to complete his review and return the submittal to the Architect. Review of shop drawings by the Architect/Engineer will be for general compliance with contract documents. No responsibility will be assumed for correctness of dimensions, quantities or details. Submit one (1) electronic print for review and comment.
 - 1. Refer to the requirements of the Conditions of the Contract and Division 1 Specification Sections for the required number of submitted copies of each submittal type.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. All materials used in the manufacture of engineered lumber shall comply with CABO Report No. NER-126.
- B. Veneer species and thickness shall be those accepted by the above referenced standard. They shall be ultrasonically graded or graded by other advanced grading systems accepted by the standard.
- C. Adhesives shall be of the waterproof type conforming to the requirements of ASTM D- 2559.
- D. All hardware shall be as called for in the details and notes on the drawings.

2.2 DESIGN

- A. The engineered lumber shall match the sizes and material properties indicated on the drawings.

2.3 FABRICATION

- A. Refer to “QUALITY ASSURANCE”.
- B. Engineered lumber shall be manufactured by Weyerhaeuser or approved equal. It shall be manufactured in a continuous process with all grain parallel with the length of the member.

2.4 IDENTIFICATION

- A. The engineered lumber shall be identified by a stamp indicating the product type, species and grade, CABO NER report number, manufacturer’s name and plant number.

PART 3 - EXECUTION

3.1 ERECTION AND INSTALLATION

- A. Refer to "QUALITY ASSURANCE".
- B. Exercise care at all times to avoid damage to laminated veneer lumber due to careless handling during storage, delivery, unloading and installation. Protect from the weather, if stored.
- C. Members shall be installed plumb, adequately braced, in the proper orientation, and as specified in the design and erection drawings.
- D. Cutting of members or field alteration is not permitted.

END OF SECTION

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standing and running trim, field finished.

B. Related Requirements:

1. Section 099123 "Interior Painting" for priming and backpriming of interior finish carpentry.

1.2 DEFINITIONS

- ##### A. MDF: Medium-density fiberboard.

1.3 ACTION SUBMITTALS

- ##### A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

- ##### B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

- ##### C. Samples: For each exposed product and for each color and texture specified.

- ##### D. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

E. Samples for Verification:

1. For each species and cut of lumber and panel products with non-factory-applied finish, with half of exposed surface finished; 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For foam-plastic moldings, with half of exposed surface finished; 50 sq. in.
3. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.

1.4 DELIVERY, STORAGE, AND HANDLING

- ##### A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

- ##### B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Low-Emitting Materials: Composite Wood or Agrifiber Products.

2.2 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
 - 1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
- B. Moldings and Trim for Paint Finish:
 - 1. Material: Medium density fiberboard.
 - 2. Patterns: As shown on Drawings.

2.3 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Multipurpose Construction Adhesive: Formulation, complying with ASTM D3498, that is recommended for indicated use by adhesive manufacturer.

2.4 FABRICATION

- A. Back out or kerf backs of the following members, except those with ends exposed in finished work:
 - 1. Interior standing and running trim, except shoe and crown molds.

- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.
 - 1. Use concealed shims where necessary for alignment.
 - 2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 INSTALLATION OF STANDING AND RUNNING TRIM

- A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.
 - 1. Do not use pieces less than 24 inches long, except where necessary.
 - 2. Stagger joints in adjacent and related standing and running trim.
 - 3. Cope at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
 - 4. Use scarf joints for end-to-end joints.
 - 5. Install trim after gypsum-board joint finishing operations are completed.

6. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
7. Fasten to prevent movement or warping.
8. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements.
 1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

3.6 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces.
- B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.7 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standing and running trim, shop finished.
2. Interior frames and jambs.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.

1.2 COORDINATION

- ##### A.
- Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.3 PREINSTALLATION MEETINGS

- ##### A.
- Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Anchors.
2. Adhesives.
3. Shop finishing materials.

- ##### B.
- Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.**

C. Shop Drawings:

1. Include the following:

- a. Dimensioned plans, elevations, and sections.
- b. Attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.

D. Samples for Verification: For the following:

1. Lumber and Panel Products with Shop-Applied Opaque Finish: 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color.

- a. Finish one-half of exposed surface.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 - 1. Installer Qualifications: Manufacturer of products.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Architectural Woodwork Standards, Section 2.
- B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.
- C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.
- B. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:

1. Low-Emitting Materials: Adhesives and Sealants.
2. Low-Emitting Materials: Composite Wood or Agrifiber Products.

2.2 ARCHITECTURAL WOODWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

2.3 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Architectural Woodwork Standards Grade: Premium.

1. Wood Species: Any closed-grain hardwood.
2. Wood Moisture Content: 5 to 10 percent.

2.4 INTERIOR FRAMES AND JAMBS FOR OPAQUE FINISH

- A. Architectural Woodwork Standards Grade: Custom.

- B. Wood Species: Any closed-grain hardwood or Eastern white pine.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (76 mm) wide.
2. Wood Moisture Content: 8 to 13.

- C. Fire-Rated Interior Frames and Jambs: Products fabricated from fire-retardant particleboard with veneered exposed surfaces or fire-retardant MDF and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing in accordance with NFPA 252.

1. Fire Rating: 20 minutes.

2.5 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

- B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.6 FABRICATION

- A. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.

1. Ease edges to radius indicated for the following:
 - a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

- b. Edges of Rails and Similar Members More Than 3/4-Inch-Thick: 1/8 inch.
- B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.
 - 1. Disassemble components only as necessary for shipment and installation.
 - 2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
 - 3. Notify Architect seven days in advance of the dates and times interior architectural woodwork fabrication will be complete.
 - 4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
 - a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
 - b. Verify that parts fit as intended and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

2.7 SHOP FINISHING

- A. Finish interior architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with Architectural Woodwork Standards, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.
- B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

- A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.
- B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.
- C. Install interior architectural woodwork level, plumb, true in line, and without distortion.
 - 1. Shim as required with concealed shims.
 - 2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

- E. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
 - 1. Secure with countersunk, concealed fasteners and blind nailing.
 - 2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
 - 3. For shop-finished items, use filler matching finish of items being installed.
- F. Standing and Running Trim:
 - 1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
 - 2. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary.
 - 3. Scarf running joints and stagger in adjacent and related members.
 - 4. Fill gaps, if any, between top of base and wall with latex sealant, painted to match wall.
 - 5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
- G. Stairs: Securely anchor carriages to supporting substrates.
 - 1. Install stairs with treads and risers no more than 1/8 inch from indicated position.
 - 2. Secure with countersunk, concealed fasteners and blind nailing.
 - 3. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with wood surface.

3.3 REPAIR

- A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.
- B. Where not possible to repair, replace defective woodwork.
- C. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.
 - 1. Fill nail holes with matching filler where exposed.
 - 2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

3.4 CLEANING

- A. Clean interior architectural woodwork on exposed and semi-exposed surfaces.

END OF SECTION

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SECTION 071616 - CRYSTALLINE WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes crystalline waterproofing for negative-side application to concrete and concrete unit masonry at elevator pit and as indicated on Drawings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include material descriptions and installation instructions for crystalline waterproofing.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

1.3 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm experienced in applying crystalline waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and that employs workers trained and approved by manufacturer.

1.4 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions.
- B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
- C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F or above during work and cure period, and space is well ventilated and kept free of water.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Field applied interior paints and coatings.
 - 2. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.2 WATERPROOFING MATERIALS

- A. Crystalline Waterproofing: Prepackaged, gray-colored proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates

into concrete and concrete unit masonry and reacts chemically with the byproducts of cement hydration in the presence of water to develop crystalline growth within substrate capillaries to produce an impervious, dense, waterproof substrate; that has VOC content complying with limits of authorities having jurisdiction; with properties meeting or exceeding the criteria specified below.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. Anti-Hydro International, Inc; A-H Hydrocap.
 - b. AQUAFIN, Inc; AQUAFIN-1C.
 - c. BASF Corporation; MasterSeal 500 (Pre-2014: Tegraproof).
 - d. Euclid Chemical Company (The); an RPM company; HEY'DI K-11.
 - e. Xypex Chemical Corporation; Xypex Concentrate.
2. Water Permeability: Maximum zero for water at 30 feet when tested according to CE CRD-C 48.
3. Compressive Strength: Minimum 4000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.3 ACCESSORY MATERIALS

- A. Portland Cement: ASTM C 150, Type I.
- B. Sand: ASTM C 144.
- C. Polymer Admixture for Protective Topping: Polymer bonding agent and admixture designed to improve adhesion to prepared substrates and not to create a vapor barrier.
 1. VOC: 0 g/L.
- D. Water: Potable.

2.4 MIXES

- A. Crystalline Waterproofing: Add prepackaged dry ingredients to water according to manufacturer's written instructions. Mix together with mechanical mixer or by hand to required consistency.
- B. Protective Topping: Measure, batch, and mix portland cement and sand in the proportion of 1:3 and water gaged with a polymer admixture. Blend together with mechanical mixer to required consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.
- B. Proceed with application only after unsatisfactory conditions have been corrected.
- C. Notify Architect in writing of active leaks or defects that would affect system performance.

3.2 PREPARATION

- A. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to ensure adequate ambient temperatures and ventilation conditions for application.
- B. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.
- C. Stop active water leaks with plugging compound according to waterproofing manufacturer's written instructions.
- D. Repair damaged or unsatisfactory substrate with patching compound according to manufacturer's written instructions.
 - 1. At holes and cracks in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and approximately 1 inch deep. Fill reveal with patching compound flush with surface.
- E. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.
 - 1. Clean concrete surfaces according to ASTM D 4258.
 - a. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
 - 2. Clean concrete unit masonry surfaces according to ASTM D 4261.
 - a. Lightweight Concrete Unit Masonry: Etch with 10 percent muriatic (hydrochloric) acid solution or abrade surface by wire brushing. Remove acid residue until pH readings of water after rinse are not more than 1.0 pH lower or 2.0 pH higher than pH of water before rinse.
 - 3. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

3.3 APPLICATION

- A. General: Comply with waterproofing manufacturer's written instructions for application and curing.
 - 1. Saturate surface with water for several hours prior to application and maintain damp condition until applying waterproofing. Remove standing water.
 - 2. Apply waterproofing to surfaces indicated on Drawings.
 - a. Apply at inside of elevator pit walls up to floor line and to top of pit slab.
 - 3. Number of Coats: Two.
 - 4. Application Method: Brush or Spray. Apply to ensure that each coat fills voids and is in full contact with substrate or previous coat.
 - 5. Dampen surface between coats.
- B. Final Coat Finish: Brushed or Spray Textured.

- C. Curing: Moist-cure waterproofing for three days immediately after final coat has set, followed by air drying, unless otherwise recommended in writing by manufacturer.
- D. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:
 - 1. Onto columns integral with treated walls.
 - 2. Onto interior nontreated walls intersecting exterior treated walls, for a distance of 24 inches for cast-in-place concrete and 48 inches for masonry.
 - 3. Onto exterior walls and onto both exterior and interior columns, for a height of 12 inches, where floors, but not walls, are treated.
 - 4. Onto every substrate in areas indicated for treatment, including pipe trenches pipe chases pits sumps and similar offsets and features.
- E. Protective Topping: Apply 1-inch-thick, protective topping over floor surfaces.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Foam-plastic board insulation.
 - 2. Spray polyurethane foam for detailing at windows and doors specified in other Sections.
- B. Related Requirements:
 - 1. Section 072119 "Foamed-In-Place Insulation" for wall applications.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Low-Emitting Materials: Insulation.
 - 3. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.2 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
 - 1. Type IV, 25 psi.

2.3 SPRAY POLYURETHANE FOAM INSULATION

- A. Low-Expansion Detailing Foam: Single-component urethane foam with low-expansion pressure, and 10 percent flexibility, suitable for installation adjacent to fenestration. Provide product complying with AAMA 812.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical; Great Stuff Pro Window & Door.
 - b. Zerodraft Products, Inc.; Zero Draft Foam Sealant.
 - c. Hilti; Window & Door Pro Foam.

2.4 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
- B. 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 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation 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. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF BELOW-GRADE INSULATION

- A. On horizontal surfaces under slabs, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

END OF SECTION

SECTION 072119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Open-cell spray polyurethane foam.
 - 2. Closed-cell spray polyurethane foam.

1.2 ACTION SUBMITTALS

- A. Product Data: for each type of product.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: for Installer.
- B. Product Test Reports: for each product, for tests performed by a qualified testing agency.
- C. Evaluation Reports: for spray-applied polyurethane foam-plastic insulation, from ICC-ES.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Thermal and Acoustic Insulation.

2.2 OPEN-CELL SPRAY POLYURETHANE FOAM INSULATION

- A. Open-Cell Spray Polyurethane Foam: Spray-applied polyurethane foam using water as a blowing agent.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Gaco; Holcim Building Envelope
 - b. Huntsman Building Solutions
 - c. NCFI Polyurethanes; a division of Barnhardt Manufacturing Company
 - 2. Type and Minimum Compressive Strength:

- a. Minimum density of 0.4 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 3.4 deg F x h x sq. ft./Btu at 75 deg F.
3. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
4. Fire-Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
5. Fire-Safety Barriers: Approved assembly as thermal barrier and ignition barrier with accessory components.

2.3 CLOSED-CELL SPRAY POLYURETHANE FOAM

- A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.
 1. Available Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Corporation; [Walltite HFO](#).
 - b. Henry Company; a Carlisle company, Permax 2.0.
 - c. Huntsman / Demilec, [HeatLok HFO Pro](#).
 2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 3. Flame-Spread Index: 25 or less.
 4. Smoke-Developed Index: 450 or less.
- B. Thermal Barrier: Where required, protect foam insulation with an approved thermal barrier with a fire rating of not less than 15 minutes as recommended in writing by foam insulation manufacturer and meeting requirements of authorities having jurisdiction.

2.4 ACCESSORIES

- A. Prescriptive Thermal Barriers: Building-code-approved materials.
 1. Gypsum Board: 1/2-inch minimum thickness.
 2. Wood Structural Panels: 23/32-inch thickness.
 3. Plywood: Nominal 1/2-inch minimum thickness.
 4. Heavy timber in accordance with the IBC.
- B. Alternate Thermal Barriers: Assembly consisting of foam insulation with applied fire-protective intumescent coating.
 1. Fire-Performance Requirements: Materials as an equivalent assembly must pass the following fire test:
 - a. NFPA 286 Fire Integrity Test: Ensures material remains in place for 15 minutes during specified large-scale fire tests. This could include UL 1715, UL 1040 or FM 4880.

2. Components:
 - a. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.
 - b. Fire-Protective Intumescent Coatings: Coating formulated for application over polyurethane foam plastics in thicknesses listed in compliance with the ICC-ES report.
- C. Equivalent Thermal Barriers: Assembly consisting of foam insulation with applied fire-protective intumescent coating.
 1. Fire-Performance Requirements: Material or equivalent assembly is in compliance with the following two fire tests:
 - a. ASTM E119 Temperature Transmission Fire Test: Average temperature rise of the unexposed surface less than 250 deg F after 15 minutes of fire exposure in accordance with ASTM E119 or UL 263.
 - b. NFPA 286 Fire Integrity Test: Ensures material remain in place for 15 minutes during specified large-scale fire tests such as NFPA 286.
 - c. NFPA 275: Combination of both ASTM E119 and NFPA 275 fire tests.
 2. Components:
 - a. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.
 - b. Fire-Protective Intumescent Coatings: Coating formulated for application over polyurethane foam plastics in thicknesses listed in compliance with the ICC-ES report.
 - c. <Insert component>.
- D. Prescriptive Ignition Barriers: Building-code-approved materials.
 1. Mineral-Fiber Insulation: 1-1/2-inch minimum thickness.
 2. Wood Structural Panel or Hardboard: 1/4-inch minimum thickness.
 3. Particleboard: 0.325-inch minimum thickness.
 4. Gypsum Wallboard: 0.325-inch minimum thickness.
 5. Corrosion-Resistant Steel: 0.016-inch base metal thickness.
 6. Cellulose Insulation: 1-1/2-inch minimum thickness, self-supported spray-applied; for attic spaces only.
- E. Alternative Ignition Barriers: Assembly consisting of foam insulation with applied fire-protective intumescent coating.
 1. Fire-Performance Requirements:
 - a. Fire-protective coating formulated for application over polyurethane foam plastics, compatible with insulation, and in compliance with ICC-ES AC377, Appendix X.
 - b. ASTM E970 radiant heat flux test.
 2. Components:
 - a. Fire-Protective Intumescent Coatings: Coating formulated for application over polyurethane foam plastics in thicknesses listed in compliance with the ICC-ES report.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Cavity Walls: Install into cavities to fully fill void.
- F. Thermal Barrier: Apply according to manufacturer's written instructions.
- G. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.3 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION

SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vapor-permeable, fluid-applied air barriers, medium-build.

1.2 DEFINITIONS

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

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
 - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by the manufacturer.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Build integrated mockups of exterior wall assembly as indicated on Drawings and Division 01 mockup requirements incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
 - b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing where applicable, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E2357.

2.3 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Low-Emitting Materials: Field applied interior paints and coatings.

2.4 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

- A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils over smooth, void-free substrates.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. DuPont Safety and Construction; DuPont Tyvek Fluid Applied WB.
 - b. Prosoco, Spray Wrap MVP.
 - c. W.R. Meadows, Inc; Air-Shield LMP.

2.5 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304, 0.0187-inch-thick, and Series 300 stainless-steel fasteners.
- D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.

3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D4263.
4. Verify that masonry joints are flush and completely filled with mortar.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

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

3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip or preformed silicone extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.
 - 2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by air-barrier material on same day. Re-prime areas exposed for more than 24 hours.
 - 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
 - 1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements but not less than 15 mils, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.

- C. Do not cover air barrier until it has been tested and inspected by testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections include the following:
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Air-barrier dry film thickness.
 - 3. Continuous structural support of air-barrier system has been provided.
 - 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 5. Site conditions for application temperature and dryness of substrates have been maintained.
 - 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 7. Surfaces have been primed, if applicable.
 - 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 - 9. Termination mastic has been applied on cut edges.
 - 10. Strips and transition strips have been firmly adhered to substrate.
 - 11. Compatible materials have been used.
 - 12. Transitions at changes in direction and structural support at gaps have been provided.
 - 13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 - 14. All penetrations have been sealed.
- C. Tests: As determined by testing agency from among the following tests:
 - 1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers.
 - 2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E783 or ASTM E2357.
 - 3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.
- D. Air barriers will be considered defective if they do not pass tests and inspections.
 - 1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 - 2. Remove and replace deficient air-barrier components for retesting as specified above.
- E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
 - 1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
 - 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION

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SECTION 074213 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concealed-fastener, lap-seam metal wall panels.
2. Soffit panels.

1.2 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- ##### A. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- ##### A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- ##### A. Fabricator/Installer Qualifications: An entity experienced in Work of this Section that that has the equipment and personnel capable of providing quality zinc wall panel profiles as indicated on the Drawings and employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems 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 and other materials beyond normal weathering.
 - 2. Warranty Period: Two 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 panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 "Quality Requirements," to design metal wall panel attachment.
- B. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 4 for enhanced protection.
 - 1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
 - 2. Small-Missile Test: For glazing located between 30 feet (9.1 m) and 60 feet (18.3 m) above grade.
- C. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 CONCEALED -FASTENER, LAP-SEAM METAL WALL PANELS

- A. Basis of Design Manufacturer: Metal Sales Manufacturing Corporation.
- B. Metallic-Coated Steel Sheet: Zinc-coated steel sheet complying with ASTM A653/A653M, G90 coating designation; structural quality, minimum 50 ksi yield strength.
 - 1. Nominal Thickness: 0.028 inch (24 gauge)..
 - 2. Surface: Smooth, flat finish.
 - 3. Attachment: Clip-attached, concealed fastener system.
 - 4. Finish: Two-coat fluoropolymer.
 - a. Colors A and B as indicated on Drawings will be selected by the Architect from manufacturer's full range.
 - b. Color C: Provide custom color matching the Architect's sample where indicated.
- 5. Panel Profiles (Refer to Drawings for locations):
 - a. Profile 1: EM1-124:
 - 1) Panel Coverage 12-inches.
 - 2) Panel Profile: 1-inch panel height; box ribs at 4-inches on center.
 - b. Profile 2: EM1-1212 CF:
 - 1) Panel Coverage 12-inches.
 - 2) Panel Profile: 1-inch panel height; 2.67-inch-wide box ribs at 12-inches on center.

- c. Profile 3: EM15-126:
 - 1) Panel Coverage 12-inches.
 - 2) Panel Profile: 1-1/2-inch panel height; 3-inch-wide box ribs at 6-inches on center.
- d. Profile 4: EM15-1266:
 - 1) Panel Coverage 12-inches.
 - 2) Panel Profile: 1-1/2-inch panel height; 6-inch-wide box ribs at 12-inches on center.
- e. Profile 5: EM15-1210:
 - 1) Panel Coverage 12-inches.
 - 2) Panel Profile: 1-1/2-inch panel height; 10-inch-wide box ribs at 12-inches on center.
- f. Profile 6: Flat Pan Soffit Panel:
 - 1) Panel Coverage: 12-inches.
 - 2) Panel Profile: 1-inch panel height.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of wall panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping 316 stainless steel screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2-inch-wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 3. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking, and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Shim or otherwise plumb substrates receiving metal panels.
 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 1. Steel Panels: Use stainless-steel fasteners.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.

4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 075423 – THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoplastic polyolefin (TPO) roofing system, adhered, on wood panel deck.
2. Accessory roofing materials.
3. Substrate board.
4. Roof insulation.
5. Insulation accessories and cover board.
6. Walkways.

B. Related Requirements:

1. Section 061000 "Rough Carpentry for general requirements for wood nailers specified in this Section.
2. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
3. Section 076200 "Sheet Metal Flashing and Trim" for shop-formed metal flashings and counterflashings, and manufactured reglets.
4. Section 077100 "Roof Specialties" for copings and roof edge flashings.
5. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
6. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

- ##### A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For insulation and roof system component fasteners, include copy of SPRI's Directory of Roof Assemblies listing.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
 - 1. Layout and thickness of insulation.
 - 2. Base flashings and membrane terminations.
 - 3. Flashing details at penetrations.
 - 4. Tapered insulation thickness and slopes, including crickets and tapers.
 - 5. Roof plan showing uplift pressures for each roof zone, orientation of steel roof deck and orientation of roof membrane and fastening spacings.
 - 6. Crickets, saddles, and tapered edge strips, including slopes.
 - 7. Wood nailer fastening patterns and details in accordance with FM DS 1-49.
 - 8. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 - 9. Tie-in with air barrier at perimeter of roofing.
- D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements for all zones including (Corner, Perimeter, and Field-of-Roof) Uplift Pressures based upon design wind speed indicated in Drawings.
- E. Samples for Verification: For the following products:
 - 1. Roof membrane and flashing, of color required.
 - 2. Walkway pads or rolls, of color required.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Contractor's Product Certificate: Submit notarized certificate, indicating products intended for Work of this Section, including product names and numbers and manufacturers' names, with statement indicating that products to be provided meet the requirements of the Contract Documents.
- C. Manufacturer Certificates:
 - 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 - 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- D. Field quality-control reports.

- E. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified listed manufacturer that is UL listed for roofing system identical to that used for this Project.
- B. Installer Qualifications: An employer of workers trained and certified by manufacturer, including a full-time on-site supervisor with a minimum of three years' experience installing products comparable to those specified, able to communicate verbally with Contractor, Architect, and employees, and qualified by the roofing system manufacturer to install manufacturer's product and furnish warranty of type specified.
- C. Manufacturer's Roofing Inspector Qualifications: A technical representative of manufacturer not engaged in the sale of products and experienced in the installation and maintenance of the specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control Article, to determine Installer's compliance with the requirements of this Project, and approved by the manufacturer to issue warranty certification. The Roofing Inspector shall be one of the following:
 - 1. An authorized full-time technical employee of the manufacturer.
 - 2. An independent party certified as a Registered Roof Observer by IIBEC, retained by the Contractor or the Manufacturer and approved by the Manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

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

- B. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 - 1. Provide tie-offs at end of each day's work to cover exposed roofing and insulation with a course of roofing sheet securely in place with joints and edges sealed.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.
 - 3. Remove temporary plugs from roof drains at end of each day.
 - 4. Remove and discard temporary seals before beginning work on adjoining roofing.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, substrate board, and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system specified in or referenced from this Section, for the following warranty period:
 - 1. Warranty Period: Two years from date of Substantial Completion.
- C. Extended Roof System Warranty: Warranties specified in this Section include the following components and systems specified in other sections supplied by the roofing system Manufacturer, and installed by the roofing system Installer:
 - 1. Sheet metal flashing and trim, including roof penetration flashings.
 - 2. Manufactured copings, roof edge, counterflashings, and reglets.
 - 3. Roof and parapet expansion joint assemblies.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
 - 1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 - 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. FORTIFIED ROOF: Meet enhanced roof performance against high wind and water penetration requirements of current FORTIFIED Multifamily Wind Standard. Comply with one of the following meeting ASCE-7 requirements:
 - 1. FM RoofNav-listed roof system.

2. ICC-ES approved system.
 3. Miami-Dade County NOA system.
 4. Texas Department of Insurance (TDI) approved system.
 5. SPRI Directory of roof Assemblies (DORA) listed assembly with appropriate wind uplift pressure capacity.
- C. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- D. Wind Uplift Resistance: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency in accordance with ANSI/FM 4474, UL 580, or UL 1897, and to resist uplift pressures calculated in accordance with ASCE-7 and applicable code.
1. All Zones (Corner, Perimeter, and Field-of-Roof) Uplift Pressures: As indicated on Contractor's approved shop drawings based upon Project design wind speed indicated on Drawings.
- E. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.
- F. Flashings: Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations of the following:
1. FMG 1-49 Loss Prevention Data Sheet for Perimeter Flashings.
 2. FMG 1-29 Loss Prevention Data Sheet for Above Deck Roof Components.
 3. NRCA Roofing Manual (Sixth Edition) for construction details and recommendations.
 4. SMACNA Architectural Sheet Metal Manual (Seventh Edition) for construction details.
- G. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- H. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
1. Low-Emitting Materials: Adhesives and Sealants located inside the roof membrane.
 2. Low-Emitting Materials: Insulation.
 3. Roofing Surface – SRI.
 4. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.3 MATERIALS, GENERAL

- A. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

2.4 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

- A. TPO Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, smooth-backed or fabric-backed TPO sheet.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Holcim Elevate.
 - c. GAF.
 - 2. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.
 - 3. Thickness: 60 mils, nominal.
 - 4. Exposed Face Color: White.

2.5 ACCESSORY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet.
- C. Membrane and Flashing Accessories: Provide polymer-coated preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, base flashings, termination reglets, scuppers, and related flashings enabling all terminations to be made using heat-welding method.
- D. Smooth-Backed Membrane Bonding Adhesive: Manufacturer's standard, water-based.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

2.6 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum substrate or ASTM C1278/C1278M, fiber-reinforced gypsum board.
 - 1. Thickness: 1/2 inch except Type X, 5/8 inch where required by fire-resistance-rated assembly.
 - 2. Surface Finish: Factory primed or unprimed as recommended by roofing membrane manufacturer based upon performance requirements.

- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.7 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by roof membrane manufacturer, approved for use in FM Approvals' RoofNav listed roof assemblies.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. Compressive Strength: 20 psi.
- C. Tapered Insulation: Provide factory-tapered insulation boards.
 - 1. Material: Match roof insulation.
 - 2. Minimum Thickness: 1/4 inch.
 - 3. Slope:
 - a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.8 WOOD NAILERS

- A. Comply with requirements of Division 06 rough carpentry section and this Article.
- B. Wood Nailer Assembly: Provide nailer assembly composed of 2 by 6 or 2 by 8 preservative treated lumber as required for perimeter configuration. Where required for coordination with thickness of adjacent insulation, use preservative-treated plywood spacers.
- C. Securement of Wood Nailers: Secure wood nailers in accordance with FM DS 1-49 for applicable roof deck. Space fasteners as indicated for Project Wind Zone.

2.9 INSULATION ACCESSORIES AND COVER BOARD

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 - 1. Bead-applied or spray-applied, low-rise, one-component or multicomponent urethane adhesive.
- D. Insulation Joint Tape: Manufacturer's recommended joint tape compatible with insulation board facing, minimum 2 inches wide.
- E. Cover Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M fiber-reinforced gypsum board.

1. Thickness: 1/2 inch.
2. Surface Finish: Factory primed or unprimed as recommended by roofing membrane manufacturer for application.

2.10 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16-inch-thick and acceptable to roofing system manufacturer.
 1. Size: Manufacturer's standard size but not less than 30 by 30 inches.
 2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

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

3.3 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to approved Shop Drawings, roofing system manufacturer's written instructions, SPRI's Directory of Roof Assemblies listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheets 1-29 and 1-49.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and auxiliary materials to tie into existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.
- D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 072726 "Fluid-Applied Membrane Air Barriers."

- E. NRCA Installation Details: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations; modify as required to comply with manufacturer's approved details and perimeter fastening requirements of FM Global references if applicable.
- F. NRCA Installation Details: Install roofing system in accordance with the following NRCA Manual Plates and NRCA recommendations; modify as required to comply with perimeter fastening requirements of FM Global references if applicable:
 - 1. Base Flashing at Parapet Wall: Plates TP-1 and TP-1S.
 - 2. Base Flashing and Counterflashing at Parapet Wall: Plates TP-5 and TP-5S.
 - 3. Base and Surface-mounted Counterflashing: Plates TP-4 and TP-4S.
 - 4. Perimeter Edge, Raised: Plates TP-2 and TP-2S.
 - 5. Perimeter Edge, Embedded Edge: Plates TP-3 and TP-3S.
 - 6. Perimeter Edge, Draining: Plates TP-3A and TP-3AS.
 - 7. Options for Perimeter Base Securement (Roof-to-Wall and Roof-to-Curb Intersections: Single Ply Table 7.1
 - 8. Options for Perimeter Base Securement (Roof-to-Wall and Roof-to-Curb Intersections: Single Ply Table 7.2
 - 9. Guide for Sheet Metal Fascia Edges for Thermoset and Thermoplastic Membrane: Single-Ply – Table 1.
 - 10. Scupper, Raised: Plates TP-21 and TP-21S.
 - 11. Expansion Joint, with metal cover: Plates TP-7 and TP-7S and Division 07 Section "Sheet Metal Flashing and Trim."
 - 12. Curb Detail at Rooftop HVAC Units Manufactured: Plates TP-12 and TP-12S.
 - 13. Curb Detail at Roof Hatch: Plates TP-14 and TP-14S.
 - 14. Penetration, Sheet Metal Enclosure: Plates TP-16 and TP-16S.
 - 15. Penetration, Stack Flashing: Plates TP-17 and TP-17S.
 - 16. Penetration, Plumbing Vent, Manufactured Boot: Plates TP-18A and TP-18AS.
 - 17. Penetration, Pocket: Plates TP-19 and TP-19S.
 - 18. Roof Drain: Plates TP-20 and TP-20S.
 - 19. Guide for Clearances between Pipes / Walls / Curbs – Table 4.
 - 20. Guide for Crickets and Saddles – Table 5.
 - 21. Guide for Edge Scuppers with Tapered Saddles - Table 6.

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.
 - 1. Tightly butt substrate boards together.
 - 2. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 3. Align substrate board for subsequent through-fastening by insulation fasteners.

3.5 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Wood Panel Decking:

1. Mechanically fasten slip sheet to roof deck using mechanical fasteners specifically designed and sized for fastening slip sheet to wood panel decks.
 - a. Fasten slip sheet according to requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
 - b. Fasten slip sheet to resist specified uplift pressure at corners, perimeter, and field of roof.
2. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows end joints staggered not less than 12 inches in adjacent rows.
 - a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - b. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - c. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
 - 1) Trim insulation so that water flow is unrestricted.
 - d. Fill gaps exceeding 1/4 inch with insulation.
 - e. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - f. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck.
 - g. Fasten insulation according to requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
 - h. Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
3. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches in adjacent rows or install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows, as applicable to insulation size.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding 1/4 inch with insulation.
 - f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - g. Adhere upper layers of insulation to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity, as follows:
 - 1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 INSTALLATION OF ADHERED ROOF MEMBRANE

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owner's testing and inspection agency.
- D. Accurately align roof membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.
- G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- H. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
 - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.8 INSTALLATION OF BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.

- B. Apply perimeter peel-stop termination bar meeting FORTIFIED ROOF requirements.
- C. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- D. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- E. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- F. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 INSTALLATION OF WALKWAYS

- A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.
 - 1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roof membrane manufacturer's warranty requirements.
 - 2. Provide 6-inch clearance between adjoining pads.
 - 3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.11 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing system for

deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

SECTION CONTINUES

3.12 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: _____.
 2. Address: _____.
 3. Building Name/Type: _____.
 4. Address: _____.
 5. Area of Work: _____.
 6. Acceptance Date: _____.
 7. Warranty Period: _____.
 8. Expiration Date: _____.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning.
 - b. peak gust wind speed exceeding 74 MPH.
 - c. fire.
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition.
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work.
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

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

1. Authorized Signature: _____
2. Name: _____
3. Title: _____

END OF SECTION

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SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed low-slope roof sheet metal fabrications.
2. Roof drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for downspout shoes.
2. Section 075423 "Thermoplastic Polyolefin (TPO) Roofing" for polymer formed and polymer-coated metal flashing components.
3. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.2 SUBMITTALS

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

B. Shop Drawings: Show installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.

1. Include details for forming, joining, supporting, and securing sheet metal flashing and trim, including pattern of seams, termination points, fixed points, expansion joints, expansion-joint covers, edge conditions, special conditions, and connections to adjoining work.

C. Delegated Design: Provide fastening details and manufacturer certificate indicating compliance with high wind design performance requirements.

D. Samples: For each exposed product and for each finish specified.

E. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

1.4 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 - 1. Exposed Coil-Coated Finishes:
 - a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
 - 2. Color: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
 - 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
- B. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.
 - 1. Obtain field measurements for accurate fit before shop fabrication.
 - 2. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- B. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

- C. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- F. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- G. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
 - a. Aluminum: 0.040 inch thick.
- B. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and built-in overflows. Fabricate from the following materials:
 - 1. Aluminum: 0.040 inch (1.02 mm) thick.
- C. Downspouts: Fabricate plain rectangular downspouts complete with mitered elbows, sized per SMACNA Manual. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Fabricated Hanger Style: SMACNA figure designation 1-35B.
 - 2. Fabricate from the following materials:
 - a. Aluminum: 0.040 inch thick.
- D. Rain Garden Flexible Downspout Extensions: PVC piping with inlet configured to match profile of downspout, 55 inch minimum, color: Brown.

2.7 LOW SLOPE ROOFING SHEET METAL FABRICATIONS

- A. Copings and Roof Edge/Fascia: Refer to Section 077100 "Roof Specialties."
- B. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Section 075423 "Thermoplastic Polyolefin (TPO) Roofing" for polymer formed and polymer-coated metal flashing components.
- C. Roof-Drain Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.0156 inch thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement so that completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 - 5. Install sealant tape where indicated.
 - 6. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
 - 1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
- D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Seal joints as shown and as required for watertight construction.
- F. Rivets: Rivet joints in uncoated aluminum where indicated and where necessary for strength.

3.3 INSTALLATION OF ROOF-DRAINAGE SYSTEM

- A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Downspouts:
 - 1. Join sections with 1-1/2-inch telescoping joints.
 - 2. Provide hangers with fasteners designed to hold downspouts securely to walls.
 - 3. Locate hangers at top and bottom and at approximately 60 inches o.c.
 - 4. Provide elbows at base of downspout to direct water away from building.
 - 5. Connect downspouts to underground drainage system.
- C. Parapet Scuppers:
 - 1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - 2. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
 - 3. Loosely lock front edge of scupper with conductor head.
 - 4. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.
- D. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper discharge.

3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
- B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- C. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copings.
 - 2. Roof-edge specialties.
- B. Related Requirements:
 - 1. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
 - 2. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.
- C. Preinstallation Conference: Conduct conference at Project site in conjunction with roofing system conference.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
 - 2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 - 3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Shop Drawings: For roof specialties.
 - 1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
 - 2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 4. Detail termination points and assemblies, including fixed points.
 - 5. Include details of special conditions.
- D. Delegated Design: Provide fastening details and manufacturer certificate indicating compliance with high wind design performance requirements.

- E. Samples: For each type of roof specialty and for each color and texture specified.
- F. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- G. Samples for Verification:
 - 1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
 - 2. Include copings and roof-edge specialties made from 12-inch lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For copings and roof-edge flashings, for tests performed by a qualified testing agency.
- B. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are SPRI ES-1 tested to specified design pressure.
- B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Division 07 roofing section.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge as shown on Drawings.
 - 2. Build mockup of typical roof edge as part of Integrated Exterior Mockup specified in Section 014000 "Quality Requirements."
 - 3. Build mockup of typical roof edge, including coping, roof edge metal, fascia, approximately 10 feet long, including supporting construction, seams, attachments, underlayment, and accessories.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 075423 "Thermoplastic Polyolefin (TPO) Roofing."
- B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. SPRI Wind Design Standard: Manufacture and install copings and roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: As indicated on Drawings.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
1. Low-Emitting Materials: Adhesives and Sealants.
 2. Responsible Sourcing: Recycled content.
 3. Documentation: Material ingredient sourcing, reporting, and optimization.
 4. Documentation: Environmental Product Declarations for Material Ingredients: EPD, HPD, CtoC, Declare.

2.3 COPINGS

- A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Petersen Aluminum Corporation; [Gold Coping](#), or a comparable product or a comparable product approved by roofing membrane manufacturer for roof system warranty.
 2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.050 inch thick.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Two-coat metallic fluoropolymer.
 - c. Color: As selected from manufacturer's full line.
 3. Corners: Factory mitered and continuously welded.
 4. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.
 - a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
 - b. Face-Leg Cleats: Concealed, continuous galvanized-steel sheet.

2.4 ROOF-EDGE SPECIALTIES

- A. Canted Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous formed galvanized-steel sheet cant, 0.028 inch thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Petersen Aluminum Corporation; [PAC-TITE Extended Snap Edge Fascia](#), or a comparable product approved by roofing membrane manufacturer for roof system warranty.
 2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.050 inch thick.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Three-coat metallic fluoropolymer.
 - a. Color: Match coping.
 3. Corners: Factory mitered and continuously welded.
 4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.

2.5 MATERIALS

- A. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

2.6 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F.
 - 2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F.

2.7 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
- B. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- E. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Coil-Coated Aluminum Sheet Finishes:
 - 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare,

pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
 1. Apply continuously under copings and roof-edge specialties.
 2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

3.3 INSTALLATION, GENERAL

- A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 4. Torch cutting of roof specialties is not permitted.
 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.
- 3.4 INSTALLATION OF COPINGS
- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.
- 3.5 INSTALLATION OF ROOF-EDGE SPECIALITIES
- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
- 3.6 CLEANING AND PROTECTION
- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 077129 - MANUFACTURED ROOF EXPANSION JOINTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flanged bellows-type roof expansion joints.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wooden curbs or cants for mounting roof expansion joints.
2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-fabricated sheet metal flashing and other sheet metal items.
3. Section 077200 "Roof Accessories" for manufactured and prefabricated metal roof curbs.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site in conjunction with roofing system conference.

1.3 ACTION SUBMITTALS

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

- B. Shop Drawings: For roof expansion joints.

1. Include plans, elevations, sections, and attachment details.
2. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
3. Provide isometric drawings of intersections, terminations, changes in joint direction or planes, and transition to other expansion joint systems depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.

- C. Samples: For each exposed product and for each color specified, 6 inches in size.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Test Reports: For each fire-barrier provided as part of a roof-expansion-joint assembly, for tests performed by a qualified testing agency.

- C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer of roofing membrane.

1.6 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Fire-Resistance Rating: Comply with ASTM E1966 or UL 2079; testing by a qualified testing agency to resist the spread of fire and to accommodate building thermal [**and seismic**] movements without impairing its ability to resist the passage of fire and hot gases. Identify products with appropriate markings of applicable testing agency.
 - 1. Rating: Not less than fire-resistance rating of the roof assembly.
 - 2. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 FLANGED BELLOWS-TYPE ROOF EXPANSION JOINTS

- A. Flanged Bellows-Type Roof Expansion Joint: Factory-fabricated, continuous, waterproof, joint cover consisting of exposed membrane bellows laminated to flexible, closed-cell support foam, and secured along each edge to 3- to 4-inch-wide metal flange.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Balco, Inc; [BRBS Series Roof to Wall and Roof to Roof](#), or a comparable product approved by roofing membrane manufacturer for roof system warranty.
 - 2. Source Limitations: Obtain flanged bellows-type roof expansion joints approved by roofing manufacturer and that are part of roofing membrane warranty.
 - 3. Joint Movement Capability: Plus, and minus 50 percent of joint size.
 - 4. Bellows: EPDM flexible membrane, nominal 60 mils thick.
 - 5. Flanges: Stainless steel.0188 inch thick.
 - 6. Configuration and Joint Size: As indicated on Drawings.
 - 7. Corner, Intersection, and Transition Units: Provide factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints.
 - 8. Cover Membrane: EPDM flexible membrane, factory laminated to bellows and covering entire joint assembly and curbs.
 - a. Color: Black.
 - 9. Accessories: Provide splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation.
 - 10. Secondary Seal: Continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary bellows assembly.

- a. Drain-Tube Assemblies: Equip secondary seal with drain tubes and seals to direct collected moisture to exterior-wall expansion joint cover.
 - b. Thermal Insulation: Fill space above secondary seal with manufacturer's standard, factory-installed mineral-fiber insulation; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84.
- 11. Fire Barrier: Manufacturer's standard fire barrier for fire-resistance-rated expansion joint system.

B. Materials:

- 1. Aluminum Sheet: ASTM B209, mill finish, with temper to suit forming operations and performance required.
 - a. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious or preservative-treated wood materials.
- 2. EPDM Membrane: ASTM D4637/D4637M, type standard with manufacturer for application.

2.3 MISCELLANEOUS MATERIALS

- A. Adhesives: As recommended by roof-expansion-joint manufacturer.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
 - 1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.
- C. Mineral-Fiber Blanket: ASTM C665.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joint openings, substrates, and expansion-control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for handling and installing roof expansion joints.
 - 1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
 - 2. Install roof expansion joints true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 3. Provide for linear thermal expansion of roof expansion joint materials.

4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
 5. Provide uniform, neat seams.
 6. Install roof expansion joints to fit substrates and to result in watertight performance.
- B. Directional Changes: Install factory-fabricated units at directional changes to provide continuous, uninterrupted, and watertight joints.
- C. Transitions to Other Expansion-Control Joint Assemblies: Coordinate installation of roof expansion joints with other exterior expansion-control joint assemblies specified in Section 079513.16 "Exterior Expansion Joint Cover Assemblies" to result in watertight performance. Install factory-fabricated units at transitions between roof expansion joints and exterior expansion-control joint systems.
- D. Splices: Splice roof expansion joints to provide continuous, uninterrupted, and waterproof joints.
1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.
- E. Fire Barrier: Install fire barrier as required by manufacturer to provide continuous, uninterrupted fire resistance throughout length of roof expansion joint, including transitions and end joints.
- F. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

END OF SECTION

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof curbs.
2. Equipment supports.
3. Condenser stands.
4. Roof hatches.
5. Pipe and duct support.
6. Pipe portals.
7. Preformed flashing sleeves.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.2 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Delegated-Design Submittal: For roof curbs and equipment supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.4 CLOSEOUT SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design roof curbs and equipment supports to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Wind-Restraint Performance: Per design wind speed indicated on Structural Drawings.

2.2 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Curbs Plus, Inc.
 - b. Greenheck Fan Corporation.
 - c. LMCurbs.
 - d. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
 - e. Thybar Corporation.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.
- D. Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet, not less than 0.052 inch thick.
 - 1. Finish: Baked enamel or powder coat.
 - 2. Color: White.
- E. Construction:
 - 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 - 2. Fabricate curbs to minimum height of 12 inches above finished roofing surface.
 - 3. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange.
 - 4. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.

5. Insulation: Factory insulated with 1-1/2-inch-thick glass-fiber board insulation.
6. Liner: Same material as curb, of manufacturer's standard thickness and finish.
7. Nailer: Factory-installed wood nailer under top flange on side of curb, continuous around curb perimeter.
8. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
9. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch-thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
10. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.
11. Damper Tray: Where applicable: Provide damper tray or shelf with opening 3 inches less than interior curb dimensions indicated.

2.3 EQUIPMENT SUPPORTS

- A. Equipment Supports: Internally reinforced perimeter metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded corner joints, and integrally formed structure-mounting flange at bottom.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Curbs Plus, Inc.
 - b. Greenheck Fan Corporation.
 - c. LMCurbs.
 - d. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
 - e. Thybar Corporation.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.
- D. Material: Zinc-coated (galvanized) or Aluminum-zinc alloy-coated steel sheet, not less than 0.052 inch thick.
 1. Finish: Baked enamel or powder coat.
 2. Color: White.
- E. Construction:
 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 2. Insulation: Factory insulated with 1-1/2-inch-thick glass-fiber board insulation.
 3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
 4. Nailer: Factory-installed continuous wood nailers 3-1/2 inches wide under top flange on side of curb, continuous around support perimeter.

5. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.
6. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch-thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
7. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
8. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.
9. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.
10. Security Grille: Provide for all units.

2.4 CONDENSER STANDS

- A. Condenser Unit and Piping Supports: Manufacturer's standard or custom designed stands fabricated from aluminum extrusions, shapes, and tubes, engineered to meet Miami-Dade County requirements, and configured to support equipment and piping indicated. Stands to consist of aluminum I-beam construction supported by multiple 2-leg crossbeam assemblies, minimum height 18 inches above roof surface, with aluminum base plate, base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck.
 1. Basis of Design: Alumistand and Vibra-Damp Corporation (AVCOA), Fort Lauderdale, FL, (800)266-7212, www.avcousa.com.
 2. Provide rubber vibration pads where recommended by manufacturer for use with condensers and motors.
 3. Pipe Support Flashing: Manufacturer's standard sleeve flashing with integral base flange; aluminum sheet, 0.063 inch thick.
 4. Finish: Manufacturer's standard.
 5. Coordinate with structural layout to accept point loads.
 6. Coordinate with roofing system design to bear on solid blocking matching thickness of adjacent roofing system.

2.5 ROOF HATCHES

- A. Roof Hatches: Thermally improved metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bilco Company (The), Single Leaf Roof Access Hatch E-50TB or a comparable product by one of the following:
 - a. Architectural Specialties, Inc.
 - b. Babcock-Davis.
 - c. Nystrom.
 - d. O'Keeffe's Inc.
 - e. Pate Company (The).
- B. Type and Size: Single-leaf lid, size as indicated on Drawings but not less than 36 by 36 inches.

- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material: Aluminum sheet.
 - 1. Thickness: Manufacturer's standard thickness for hatch size indicated.
 - 2. Finish: Baked enamel or powder coat.
 - 3. Color: White.
- E. Construction:
 - 1. Insulation: 3-inch-thick, polyisocyanurate board.
 - a. R-Value: 20.0 according to ASTM C1363.
 - 2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
 - 3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - 4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - 5. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
 - 6. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant. Equip hatch with water diverter or cricket on side that obstructs water flow.
- F. Hardware: Spring operators, hold-open arm, stainless steel spring latch with turn handles, stainless steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
 - 1. Provide two-point latch on lids larger than 84 inches.
 - 2. Provide remote-control operation.
- G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
 - 1. Height: 42 inches above finished roof deck.
 - 2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
 - 3. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
 - 4. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
 - 5. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
 - 6. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
 - 7. Fabricate joints exposed to weather to be watertight.
 - 8. Fasteners: Manufacturer's standard, finished to match railing system.
 - 9. Finish: Manufacturer's standard baked enamel or powder coat.
 - a. Color: Safety yellow.
- H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches above finished roof deck.
3. Material: Steel tube.
4. Post: 1-5/8-inch-diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat.
 - a. Color: Safety yellow.

2.6 PIPE AND DUCT SUPPORTS

- A. Fixed-Height Cradle-Type Pipe Supports: Polycarbonate pipe stand accommodating up to 1-1/2-inch-diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type as required for quantity of pipe runs and sizes.
- B. Fixed-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand with stainless-steel roller carrying assembly accommodating up to 7-inch-diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type as required for quantity of pipe runs and sizes.
- C. Adjustable-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand base, pipe support, and roller housing, with stainless-steel threaded rod designed for adjusting support height, accommodating up to 18 inch diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.
- D. Adjustable-Height Structure-Mounted Pipe Supports: Extruded-aluminum tube, filled with urethane insulation; 2 inches in diameter; accommodating up to 7-inch-diameter pipe or conduit, with provision for pipe retainer; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, stainless-steel roller and retainer, and extruded-aluminum carrier assemblies; as required for quantity of pipe runs and sizes.
- E. Curb-Mounted Pipe Supports: Galvanized steel support with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom; with adjustable-height roller-bearing pipe support accommodating up to 20-inch-diameter pipe or conduit and with provision for pipe retainer; as required for quantity of pipe runs and sizes.
- F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. MIRO Industries, Inc.
 2. Pate Company (The).
 3. PHP Systems/Design.
 4. Thaler Metal Industries Ltd.
- G. Finish: Manufacturer's standard.

2.7 PIPE PORTALS

- A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-

sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless-steel snaplock swivel clamps.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.

- B. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless-steel snaplock swivel clamps.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.

2.8 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.

1. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, AZ50 coated.

1. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.

- C. Aluminum Sheet: ASTM B209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

- D. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

- E. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.

- F. Steel Tube: ASTM A500/A500M, round tube.

- G. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.

- H. Steel Pipe: ASTM A53/A53M, galvanized.

2.9 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- E. Underlayment:
 - 1. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
- F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- H. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- I. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- J. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- E. Roof-Hatch Installation:
 - 1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 - 2. Attach safety railing system to roof-hatch curb.
 - 3. Attach ladder-assist post according to manufacturer's written instructions.
- F. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.
 - 1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

- G. Preformed Flashing-Sleeve and Flashing Pipe Portal Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.
- H. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems bearing marking of qualified testing and inspection agency.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Low-Emitting Materials: Insulation.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hilti, Inc.
 - 2. Specified Technologies, Inc.
 - 3. Tremco, Inc.

2.3 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. Horizontal assemblies include floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
 - 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 - 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

END OF SECTION

SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
2. Section 079500 "Expansion Control" for fire-resistive architectural joint systems.
3. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Laboratory Test Reports: For joint firestopping system sealants, indicating compliance with requirements for low-emitting materials.

B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."

2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. 3M Fire Protection Products.
 - b. Hilti, Inc.
 - c. Specified Technologies, Inc.
 - d. Tremco, Inc.
 - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

- D. Low-Emitting Materials: Fire-resistive joint system sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

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

3.4 IDENTIFICATION

- A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION

SECTION 079100 - PREFORMED JOINT SEALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Preformed, foam joint seals.
 - 2. Preformed, fire-resistance-rated foam joint seals.

1.2 ACTION SUBMITTALS

- A. Product Data: For each preformed joint seal product.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each product exposed to view.
- D. Samples for Verification: For each type and color of preformed joint seal required, provide Samples with joint seals in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint seals.
- E. Preformed Joint Seal Schedule: Include the following information:
 - 1. Joint seal location and designation.
 - 2. Joint width and movement capability.
 - 3. Joint seal manufacturer and product name.
 - 4. Joint seal color.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranties: For special warranties.

1.4 QUALITY ASSURANCE

- A. Mockups: Install mockups of assemblies specified in other Sections that are indicated to receive preformed joint seals specified in this Section. Use materials and installation methods specified in this Section.

1.5 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace preformed joint seals 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 agrees to furnish preformed joint seals 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: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:

1. Low-Emitting Materials: Adhesives and Sealants.
2. Low-Emitting Materials: Insulation.

2.2 PREFORMED, FOAM JOINT SEALS

- A. Preformed, Foam Joint Seals: Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in pre-compressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.

1. Basis-of-Design Product: Subject to compliance with requirements, Emseal Joint Systems Ltd., Seismic Colorseal, or comparable product by one of the following:

- a. LymTal International Inc.
- b. Schul International Company, Inc.

2. Design Criteria:

- a. Nominal Joint Width: As indicated on Drawings.
- b. Movement Capability: As indicated on Drawings.

3. Joint Seal Color: As selected by Architect from full range of industry colors.

- B. Preformed, Fire-Resistance-Rated Foam Joint Seals: Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in pre-compressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.

1. Basis-of-Design Product: Subject to compliance with requirements, Emseal Joint Systems LTD., [Emshield WFR2 System](#), or comparable product by one of the following:

- a. LymTal International Inc.
- b. Schul International Company, Inc.

2. Design Criteria:

- a. Nominal Joint Width: As indicated on Drawings.
- b. Movement Capability: As indicated on Drawings.
- c. Fire Resistance Rating, UL 2079: 2 hours.
- d. Application: Precast concrete wall panel sealant joint backer.

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by preformed-joint-seal manufacturer for joint substrates indicated.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to preformed joint seal manufacturer, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces; and formulated to promote best adhesion to joint substrates.
- C. Masking Tape: Nonstaining, non-absorbent material compatible with preformed joint seals and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive preformed joint seals, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting preformed-joint seal performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing preformed joint seals to comply with preformed joint seal manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of preformed joint seal, including dust, paints (except for permanent protective coatings tested and approved for seal adhesion and compatibility by seal manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimal bond with preformed joint seals. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint seals. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.

- B. Joint Priming: Prime joint substrates where recommended by preformed joint seal manufacturer or as indicated by tests or prior experience. Apply primer to comply with joint seal manufacturer's written instructions. Confine primers to areas of joint seal bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of adhesive or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

- A. General: Comply with preformed joint seal manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Installation of Preformed, Foam Joint Seals:
 - 1. Install each length of seal immediately after removing protective wrapping.
 - 2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
 - 3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
 - 4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

3.4 PROTECTION

- A. Protect preformed joint seals from damage resulting from construction operations or other causes so seals are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated seals immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Latex joint sealants.
 - 4. Immersible joint sealants for flood-resistant construction.

1.2 PRECONSTRUCTION CONFERENCE

- A. Convene a meeting at the Project site to review the work of this section, including but not limited to requirements for specified testing and detailing of joints subject to flooding.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.'
- B. Shop Drawings: Provide sealant manufacturer's recommended details for flood-resistant joint construction.
- C. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- D. Samples: For each kind and color of joint sealant required.

1.5 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Preconstruction field-adhesion test reports.
- C. Warranties.

1.6 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace 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 joint-sealant manufacturer agrees to furnish 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: Exterior Silicone Joint Sealants: 15 years from date of Substantial Completion.
 - 2. Warranty Period: Exterior Urethane Joint Sealants: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Documentation: Material ingredient sourcing, reporting, and optimization.
 - 3. Documentation: Environmental Product Declarations for Material Ingredients: EPD, HPD, CtoC, Declare.

2.2 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As scheduled, or if not scheduled, as selected by Architect from manufacturer's full range.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

2.3 SILICONE JOINT SEALANTS

- A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant **ES-2**: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 795.
 - b. Pecora Corporation; 864.
 - c. Tremco Incorporated; Spectrem 2.
- B. Mildew-Resistant, Single-Component, Neutral- or Acid -Curing Silicone Joint Sealant **ES-3**: Contractor Option: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 786 Mildew Resistant.
 - b. Pecora Corporation; 898.
 - c. Tremco Incorporated; Tremsil 200 Sanitary.

2.4 URETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Paintable Urethane Joint Sealant **ES-4**: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
- a. Pecora Corporation; Dynatrol I-XL.
 - b. Sika Corporation, Construction Products Division; Sikaflex - 1a.
 - c. Tremco Incorporated; Dymonic FC, Vulkem 116.
- B. Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant **ES-5**: ASTM C 920, Type S, Grade P, Class 25, for Use T.
1. Products: Subject to compliance with requirements, provide one of the following:
- a. Pecora Corporation; Urexpand NR-201.
 - b. Sika Corporation, Construction Products Division; Sikaflex - 1CSL.
 - c. Tremco Incorporated; Vulkem 45.

2.5 LATEX JOINT SEALANTS

- A. Latex Joint Sealant LS-1: Siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
1. Products: Subject to compliance with requirements, provide one of the following:
- a. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. Pecora Corporation; AC-20+.
 - d. Schnee-Morehead, Inc.; SM 8200.
 - e. Tremco Incorporated; Tremflex 834.

2.6 IMMERSIBLE JOINT SEALANTS

- A. Immersible Joint Sealants: Suitable for immersion in liquids; ASTM C1247, **Class 1**; tested in deionized water unless otherwise indicated.
- B. Acceptable Manufacturers: Subject to compliance with requirements, acceptable manufacturers of immersible joint sealants include but are not limited to the following:
- 1. W.R. Meadows.
 - 2. Sika Corporation.
 - 3. Tremco.
- C. Urethane, Immersible, S, NS, 35, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Uses NT and I.
- D. Urethane, Immersible, S, NS, 50, T, NT, I: Immersible, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T, NT, and I.

2.7 JOINT SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
- F. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.3 EXTERIOR JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application JS-1: Exterior vertical control and expansion joints in unit masonry.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant ES-2.
- B. Joint-Sealant Application JS-4: Exterior perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant ES-2.
- C. Joint-Sealant Application JS-5: Exterior joints in siding and between siding and other materials scheduled to receive paint.
 - 1. Joint Sealant: Single-component urethane sealant ES-4, paintable.
- D. Joint-Sealant Application JS-5: Exterior perimeter joints between materials listed above and frames of doors, windows, and louvers.
 - 1. Joint Sealant: Single-component neutral-curing silicone sealant ES-2, color selected to match siding paint color.

3.4 INTERIOR JOINT SEALANT SCHEDULE

- A. Joint-Sealant Application JS-21: Vertical control and expansion joints on exposed interior surfaces of exterior walls.
 - 1. Joint Sealant: Single-component nonsag urethane sealant ES-4, paintable.

- B. Joint-Sealant Application JS-22: Interior perimeter joints of exterior openings.
 - 1. Joint Sealant: Single-Component nonsag urethane sealant ES-4, paintable.
- C. Joint-Sealant Application JS-23: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.
 - 1. Joint Sealant: Single-component mildew-resistant neutral -curing silicone sealant ES-3.
 - 2. Joint-Sealant Color: As direct by Architect.
- D. Joint-Sealant Application JS-26: Perimeter joints between painted interior wall surfaces and frames of interior doors, windows and elevator entrances.
 - 1. Joint Sealant: Latex sealant LS-1.
 - 2. Joint-Sealant Color: Paintable white.

END OF SECTION

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical joint sealants.

1.2 ACTION SUBMITTALS

- A. Product Data: For each acoustical joint sealant.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.

2.2 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Documentation: Material ingredient sourcing, reporting, and optimization.
 - 3. Documentation: Environmental Product Declarations for Material Ingredients: EPD, HPD, CtoC, Declare.

2.3 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; AC-20 FTR.
 - b. Tremco Incorporated; Tremco Acoustical Sealant.
 - c. USG Corporation; SHEETROCK Acoustical Sealant.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 079513 - INTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes interior expansion joint cover assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.
- B. Shop Drawings: For each expansion joint cover assembly.
 - 1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
 - 2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- C. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
 - 1. Manufacturer and model number for each expansion joint cover assembly.
 - 2. Expansion joint cover assembly location cross-referenced to Drawings.
 - 3. Nominal, minimum, and maximum joint width.
 - 4. Movement direction.
 - 5. Materials, colors, and finishes.
 - 6. Product options.
 - 7. Fire-resistance ratings.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Furnish units in longest practicable lengths to minimize field splicing.
- B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E1966 by a qualified testing agency.
 - 1. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies shall be subjected to hose stream testing.
- B. Expansion Joint Design Criteria:

1. Nominal Joint Width: As indicated on Drawings.
2. Minimum Joint Width: As indicated on Drawings.
3. Maximum Joint Width: As indicated on Drawings.

2.3 MANUFACTURERS/PRODUCTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide listed products of Construction Specialties, Inc.; or a comparable product by one of the following:

1. Architectural Art Manufacturing Inc.; a division of Pittcon Architectural Metals, LLC.
2. Balco; a CSW Industrials Company.
3. BASF Corp. - Watson Bowman Acme Corp.
4. Nystrom.

2.4 FLOOR EXPANSION JOINT COVERS

- A. Surface Floor Joint Cover: Assembly consisting of surface mounted floor cover features a single gasket and is designed for interior applications.

1. Basis of Design: Construction Specialties (CS) Expansion Joint Cover.
 - a. Floor to floor: GFS Series.
 - b. Floor to wall: GFSW Series.
2. Installation: Surface mount.
3. Exposed Metal: Aluminum: Mill.
4. Fire Barrier: Manufacturer's standard fire-resistive joint system with ratings determined per ASTM E 1966 or UL 2079 to resist spread of fire and to accommodate building thermal movements without impairing its ability to resist the passage of fire and hot gases.
 - a. Fire-Resistance Rating: Not less than fire-resistance rating of the floor assembly.
 - b. Moisture Barrier: At slabs on ground.

2.5 WALL EXPANSION JOINT COVERS

- A. Center-Plate Wall Joint Cover: Assembly consisting of center plate that slides over gaskets in metal frames fixed to sides of joint gaps.

1. Basis of Design: [Construction Specialties \(CS\) Expansion Joint Cover ASM/ASMC](#).
2. Application: Wall to wall and Wall to corner.
3. Installation: Surface applied.
4. Exposed Metal: Aluminum: Primed for field painting.
5. Cover Plate Design: Smooth.
6. Fire Barrier: Where applicable: Manufacturer's standard fire-resistive joint system with ratings determined per ASTM E 1966 or UL 2079 to resist spread of fire and to accommodate building thermal movements without impairing its ability to resist the passage of fire and hot gases.
 - a. Fire-Resistance Rating: Not less than fire-resistance rating of the wall assembly.
 - b. Moisture Barrier: At exterior walls.

2.6 CEILING EXPANSION JOINT COVERS

- A. Center-Plate Wall Joint Cover: Assembly consisting of center plate that slides over gaskets in metal frames fixed to sides of joint gaps.
 - 1. Basis of Design: [Construction Specialties \(CS\) Expansion Joint Cover ASM/ASMC](#).
 - 2. Application: Ceiling to ceiling [and Wall to ceiling].
 - 3. Exposed Metal:
 - a. Aluminum: Mill, primed for field painting.
- B. Elastomeric-Seal Acoustical Ceiling Joint Cover: Elastomeric-seal assembly designed for use in acoustical ceilings.
 - 1. Basis of Design: [Construction Specialties \(CS\) Expansion Joint Cover FCF](#).
 - 2. Application: Ceiling to ceiling [and Wall to ceiling].
 - 3. Exposed Metal:
 - a. Aluminum: Factory painted to match ceiling grid.
 - 4. Seal: Preformed elastomeric membranes or extrusions.
 - a. Color: As selected by Architect from manufacturer's full range.

2.7 MATERIALS

- A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate.
 - 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.
- C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.
- D. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.8 ALUMINUM FINISHES

- A. Mill finish.

2.9 ACCESSORIES

- A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane of flexible elastomeric material within joint and attached to substrate on sides of joint.
 - 1. Provide where indicated on Drawings.

- B. Manufacturer's standard attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.
- B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.
- B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
 - 1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
 - 2. Install frames in continuous contact with adjacent surfaces.
 - a. Shimming is not permitted.
 - 3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
 - 5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 - 6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.
- C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
 - 1. Provide in continuous lengths for straight sections.
 - 2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.

- 3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
 - D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.
 - E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.
 - F. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
 - 1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
 - G. Moisture Barrier Drainage: If indicated, provide drainage fittings and connect to drains.
- 3.4 PROTECTION
- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
 - B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION

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SECTION 079513.16 - EXTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior expansion joint covers, fire rated.

B. Related Requirements:

1. Section 079100 "Preformed Joint Seals" for preformed foam and extruded-silicone joint seals.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

1. Exterior expansion joint covers.

B. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each exposed expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E1966 by a qualified testing agency.

1. Hose Stream Test: Wall-to-wall and wall-to-soffit assemblies shall be subjected to hose stream testing.

B. Expansion Joint Design Criteria:

1. Type of Movement: Thermal.
 - a. Nominal Joint Width: As indicated on Drawings.
 - b. Minimum Joint Width: As indicated on Drawings.
 - c. Maximum Joint Width: As indicated on Drawings.

2.3 EXTERIOR EXPANSION JOINT COVERS

A. Exterior Metal-Plate Joint Cover: Assembly consisting of sliding metal cover plate in continuous contact with gaskets mounted on metal frames fixed to sides of joint gap.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Balco; a CSW Industrials Company.
 - b. Construction Specialties, Inc.
 - c. Watson Bowman Acme Corp.
2. Application: Wall to wall.
3. Installation: Surface mounted.
4. Fire-Resistance Rating: Not less than that of adjacent construction.
5. Exposed Metal:
 - a. Aluminum: Powder coated: Color to match adjacent metal panel color selection.

2.4 MATERIALS

- A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate.
 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.
- C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.
- D. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

2.5 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.6 ACCESSORIES

- A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.
 - 1. Provide where indicated on Drawings.
- B. Manufacturer's standard stainless steel attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.
- B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.
- B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
 - 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
 - 3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 - 4. Install frames in continuous contact with adjacent surfaces.
 - a. Shimming is not permitted.
 - 5. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.
- C. Elastomeric Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
 2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 3. Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.
- E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.
- F. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
- G. Moisture Barrier Drainage: If indicated, provide drainage fitting and connect to drains.

3.4 CONNECTIONS

- A. Transition to Roof Expansion Joint Covers: Coordinate installation of exterior wall and soffit expansion joint covers with roof expansion joint covers specified in Section 077129 "Manufactured Roof Expansion Joints."

3.5 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Interior standard steel doors and frames.
 - 2. Exterior standard steel doors and frames.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
 - 2. Section 088000 "Glazing" for safety glazing installed in hollow metal doors and frames.
 - 3. Section 099113 "Exterior Painting" and 099123 "Interior Painting" for field painting of factory primed hollow metal doors and frames.

1.2 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
- C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

- A. Hurricane Resistant Openings: Provide copy of current State of Florida Product Approval or Metro-Dade County Notice of Acceptance (NOA) as proof of compliance that doors, frames and

hardware for exterior opening assemblies have been tested and approved for use at the wind load and design pressure level requirements specified for the Project.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ceco Door; ASSA ABLOY.
 - 2. Curries Company; ASSA ABLOY.
 - 3. Deansteel Manufacturing Company, Inc.
 - 4. Fleming Door Products Ltd.; Assa Abloy Group Company.
 - 5. Mesker Door Inc.
 - 6. Pioneer Industries.
 - 7. Republic Doors and Frames.
 - 8. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.
- B. Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.7deg F x h x sq. ft./Btu when tested according to ASTM C 1363 for door/frame operable opening assemblies.
- C. Hurricane Resistant Exterior Openings: Provide exterior hollow metal doors and frames as complete and tested assemblies, or component assemblies, including approved hardware specified under Section 087100 "Door Hardware", to meet the wind loads, design pressures, debris impact resistance, and glass and glazing requirements as detailed in the current State of Florida building code sections applicable to the Project.
 - 1. Each unit to bear third party permanent label in accordance with Florida Building Code requirements.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - a. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
 - b. Edge Construction: Model 2, Seamless.
 - c. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - d. Core: Manufacturer's standard.
 - e. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.
 - 2. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
 - b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Face welded.
 - 3. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: Polyurethane.
 - 2. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.

b. Construction:

- 1) Full profile welded.

3. Exposed Finish: Prime.

2.5 BORROWED LITES

- A. Fabricate of uncoated and metallic-coated steel sheet, minimum thickness of 0.042 inch.
- B. Construction: Face welded.
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 FRAME ANCHORS

- A. Jamb Anchors:
 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
 3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.7 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

- F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.8 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. Sidelite Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - 1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.9 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

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

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. Install exterior hollow metal doors and frames in accordance with the FPA or NOA, as submitted, and the manufacturer's written instructions.
- B. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- C. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 2. Fire-Rated Openings: Install frames according to NFPA 80.
 3. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 4. Metal-Stud Partitions: Fully fill frames with mineral-fiber insulation.
 5. Masonry Walls: Do not fill frames with grout.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus, or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus, or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus, or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus, or minus 1/16 inch, measured at jambs at floor.

- D. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- E. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

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SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flush wood MDF-faced doors for painted finish.
2. Factory machining for hardware.

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames."
2. Section 087100 "Door Hardware."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Factory- finishing specifications.

B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
2. Details of frame for each frame type, including dimensions and profile.
3. Dimensions and locations of blocking for hardware attachment.
4. Dimensions and locations of mortises and holes for hardware.
5. Clearances and undercuts.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

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 rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - c. Telegraphing of core construction in face exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 including the following:
 - 1. Low-Emitting Materials: Field applied adhesives and sealants.
 - 2. Low-Emitting Materials: Composite Wood or Agrifiber Products.

2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products of Forte Opening Solutions (Masonite); or comparable products by one of the following:
 - 1. Oregon Door.
 - 2. Oshkosh Door Company.
 - 3. VT Industries Inc.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

2.4 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.
 - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.5 SOLID-CORE FLUSH WOOD DOORS FOR OPAQUE FINISH

- A. Interior Solid-Core Doors:
 - 1. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.
 - 2. ANSI/WDMA I.S. 1A Grade: Custom.
 - 3. Faces: MDF ANSI A208.2, Grade 150 or Grade 160.
 - 4. Exposed Vertical Edges: Match faces.
 - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.
 - 5. Core for Non-Fire-Rated Doors:
 - a. ANSI A208.1, Grade LD-2 particleboard.
 - 1) Provide doors with WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087100 "Door Hardware."
 - b. WDMA I.S. 10 structural composite lumber.
 - 1) Screw Withdrawal, Door Face: 550 lbf.
 - 2) Screw Withdrawal, Vertical Door Edge: 550 lbf.
 - 6. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
 - a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.
 - 7. Construction: Five- or seven- plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.6 LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
 - 2. Profile: Manufacturer's standard shape.
 - 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Metal Frames for Lite Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish in color selected by Architect; and approved for use in doors of fire-protection rating indicated on Drawings.

2.7 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
 - 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 2. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
 - 1. Locate hardware to comply with DHI-WDHS-3.
 - 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 - 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
- C. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.8 FINISHING

2.9 FINISHING

- A. Comply with referenced quality standard for finishing.
 - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 2. Finish faces, all four edges, edges of cutouts, and mortises.
- B. Opaque Finish: Finish: 3-coat acrylic enamel system, including primer, intermediate, and finish coats specified in Section 099123 "Interior Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed 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 Section 087100 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install fire-rated doors and frames in accordance with NFPA 80.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. 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 that 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

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SECTION 081433 - STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior stile and rail wood doors.
2. Shop fitting stile and rail wood doors to frames and factory machining for hardware.
3. Shop priming.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Details of construction and glazing.
2. Door frame construction.
3. Factory-machining criteria.
4. Factory-finishing specifications.

B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data, including the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimensions and location of hardware, lite locations, and glazing thickness.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of mortises and holes for hardware.
6. Clearances and undercuts.
7. Doors to be factory primed and application requirements.

D. Samples for Verification:

1. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS.

A. Special warranties.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 FIELD CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during remainder of construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors and frames that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors and frames.
 - 3. Warranty shall be in effect during specified period of time from date of Substantial Completion.
 - 4. Warranty Period for Exterior Doors: Two years.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Low-Emitting Materials: Composite Wood or Agrifiber Products.

2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide [Aspiro Stile and Rail Doors](#) of Forte Opening Solutions, or comparable product of one of the following:
 - 1. Oshkosh Door Company.
 - 2. Oregon Door.
 - 3. VT Industries Inc.
- B. Source Limitations:

1. Obtain stile and rail wood doors from single manufacturer.

2.3 MATERIALS

- A. Use only materials that comply with referenced standards and other requirements specified.
 1. Assemble exterior doors, including components, with wet-use adhesives complying with ASTM D5572 for finger joints and with ASTM D5751 for joints other than finger joints.
- B. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

2.4 INTERIOR STILE AND RAIL WOOD DOORS

- A. Interior Stile and Rail Wood Doors: Interior doors complying with WDMA I.S. 6A and with other requirements specified.
 1. Performance Grade:
 - a. WDMA I.S. 6A: Heavy Duty.
 - b. WDMA I.S. 6A: Premium.
 2. Panel Designs: Indicated on Drawings. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
 3. Facing: MDF ANSI A208.2, Grade 150 or Grade 160.
 4. Exposed Vertical Edges: Match faces.
 5. Finish: Opaque.
 6. Door Construction for Opaque Finish:
 - a. Stile and Rail Construction:
 - 1) Clear softwood: may be edge glued for width and finger jointed.
 - 2) Veneered, structural composite lumber or veneered edge- and end-glued lumber.
 - b. Panel Construction: Shaped, medium-density fiberboard.
 7. Stile and Rail Widths: As indicated, or if not indicated, manufacturer's standard, but not less than the following:
 - a. Stiles, Top and Intermediate Rails: 4-1/2 inches.
 - b. Bottom Rails: 9 inches.
 8. Raised-Panel Thickness: Manufacturer's standard, but not less than 3/4 inch.
 9. Flat-Panel Thickness: 1/2 inch.
 10. Molding Profile (Sticking): As selected by Architect from manufacturer's full range.
 11. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S. 6A and grade specified.

2.5 STILE AND RAIL WOOD DOOR FABRICATION

- A. Shop fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated:

1. Clearances:
 - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
 - b. Provide 1/2 inch from bottom of door to top of decorative floor finish or covering.
 - c. Where threshold is shown on Drawings or scheduled, provide not more than 3/8 inch from bottom of door to top of threshold.
2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
- B. Fabricate stile and rail wood doors in sizes indicated for field fitting.
- C. Shop machine doors for hardware that is not surface applied.
 1. Locate hardware to comply with DHI-WDHS-3.
 2. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 3. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
 4. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- D. Glazed Openings:
 1. Shop install glazing in doors, complying with Section 088000 "Glazing." Install glass using manufacturer's standard elastomeric glazing sealant complying with ASTM C920. Secure glass in place with removable wood moldings. Miter wood moldings at corner joints.
 2. Coordinate installation of clear and translucent glazing units as indicated on Drawings.

2.6 FINISHING

- A. Comply with referenced quality standard for finishing.
 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 2. Finish faces, all four edges, edges of cutouts, and mortises.
- B. Opaque Finish: Finish: 3-coat acrylic enamel system, including primer, intermediate, and finish coats specified in Section 099123 "Interior Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed 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 Section 087100 "Door Hardware."

- B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Shop-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Shop- 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

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SECTION 081700 – INTEGRATED ENTRY DOOR ASSEMBLIES, INSULATED METAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Insulated prehung door assemblies, fire-rated, including:
 - 1. Metal-faced insulated composite door.
 - 2. Composite door frames.
 - 3. Door hardware.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings and Schedule: Indicate location, size, and hand of each typical door; elevation of each kind of door; construction details not covered in Product Data; and other pertinent data.
- C. Samples: Finish sample of doors, frames, and each type of hardware.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Energy Performance, ENERGY STAR: Provide entry doors that qualify for the EPA/DOE ENERGY STAR product labeling program.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Dor-Win Manufacturing Co.
 - 2. Taylor Building Products.
 - 3. Therma-Tru Corp.

2.3 INSULATED METAL COMPOSITE DOOR ASSEMBLIES

- A. Door Style: Patterns indicated on Drawings.
 - 1. Door Face: 24 ga. electrogalvanized steel.
 - 2. Door Edge: Steel.
 - 3. Door Core: Solid polyurethane foamed core.
 - 4. Glazing: 5/8-inch tempered insulating glass unit, air-filled, safety glazing labeled.
 - 5. Finish: Manufacturer's standard finish in color selected by Architect from manufacturer's full line.
- B. Frame: Door manufacturers standard wood frames for flush installation into finished stud walls.
 - 1. Kerfed for weatherstripping application.
 - 2. Threshold: Factory-applied thermally broken aluminum threshold meeting accessibility requirements and NFPA-80 where applicable.
 - 3. Exterior Casing: Brick Mould or 5/4-inch-thick composite flat profile as appropriate for conditions.

4. Finish: Shop-primed.

2.4 DOOR HARDWARE

- A. Weatherstrip: Manufacturer's standard compression type, factory installed.
- B. Sweep: Manufacturer's standard back-of-door mounted height adjustable vinyl and aluminum type.
- C. Hinges: Manufacturer's standard stainless steel ball bearing, 4 by 4 by 0.098 inches self-closing hinges, screws to match selected finish.
 1. Finish: US32D stainless steel.
- D. Lockset: Refer to Section 087100 "Door Hardware."
- E. Door Viewer: Wide angle, in finish to match door hardware.
 1. Provide second viewer at accessible unit entries.

2.5 INSTALLATION ACCESSORIES

- A. Weatherstrip Corner Pad: Manufacturer's standard.
- B. Sill Bedding Sealant: Butyl-Rubber-Based Joint Sealants: ASTM C1311.
- C. Sill Pan: Refer to Section 076200 "Sheet Metal Flashing and Trim."

2.6 DOOR AND FRAME FABRICATION

- A. Fabricate doors and frames in sizes indicated for field fitting.
- B. Factory machine doors and frames for hinges, locksets, and deadbolts.
- C. Doors: Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated:
- D. Factory-prepare doors and frames for field-applied locksets, deadbolts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install doors to comply with manufacturer's written instructions, and other requirements specified.
- B. Install door frames level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment. Shim solid behind hinges.
- C. Hardware: For installation, see Division 08 Section "Door Hardware."
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

END OF SECTION

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings if applicable, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Product Schedule: For access doors and frames, keyed to floor plan.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Nystrom; Architectural Access Door. or a comparable product by one of the following:
 - 1. Cendrex Inc.
 - 2. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - 3. Karp Associates, Inc.
 - 4. Larsens Manufacturing Company.
 - 5. Milcor; a division of Hart & Cooley, Inc.

2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Concealed Flanges:
 - 1. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
 - 2. Locations: Wall and ceiling.
 - 3. Door Size: 16 by 16 inches unless otherwise indicated on Drawings.
 - 4. Metallic-Coated Steel Sheet for Door: Nominal 0.064-inch, 16 gage factory primed.
 - 5. Frame Material: Same material and thickness as door.
 - 6. Latch and Lock: Cam latch, hex-head wrench operated.
- B. Flush Access Doors with Exposed Flanges:
 - 1. Description: Face of door flush with frame, with exposed flange and concealed hinge.
 - 2. Locations: Maintenance areas.
 - 3. Door Size: 24 by 32 inches unless otherwise indicated on Drawings.
 - 4. Metallic-Coated Steel Sheet for Door: Nominal 0.064-inch, 16 gages, factory primed.
 - 5. Frame Material: Same material, thickness, and finish as door.
 - 6. Latch and Lock: Prepared for mortise cylinder, with interior release.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
- D. Latch Hardware:
 - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION

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SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service doors.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3. Include description of automatic-closing device and testing and resetting instructions.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
5. Show locations of controls, locking devices, and other accessories.
6. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
 - 1. Design Wind Load: As indicated on Drawings.
 - 2. Testing: According to ASTM E330/E330M.
 - 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

2.3 DOOR ASSEMBLY

- A. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cookson Company.
 - b. Cornell Iron Works.
 - c. McKeon Rolling Steel Door company, Inc.
 - d. Overhead Door Corporation.
- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Door Curtain Material: Galvanized steel.
- D. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from hot-dip galvanized steel and finished to match door.
- E. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- F. Hood: Galvanized steel.

1. Shape: Round.
2. Mounting: Between jambs.

G. Locking Devices: Equip door with locking device assembly and chain lock keeper.

1. Locking Device Assembly: Cremone-type, both jamb sides locking bars, operable from inside with thumb turn and outside with cylinder.

H. Electric Door Operator:

1. Usage Classification: Medium duty, up to 12 cycles per hour and up to 50 cycles per day.
2. Operator Location: As indicated on Drawings.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. or lower.
4. Motor Exposure: Exterior, wet, and humid.
5. Motor Electrical Characteristics: As recommended by door manufacturer for size and weight of door.
6. Emergency Manual Operation: Chain type.
7. Obstruction-Detection Device: Automatic pneumatic sensor edge on bottom bar.
 - a. Sensor Edge Bulb Color: Black.
8. Control Station(s): Exterior mounted.
9. Other Equipment: Audible and visual signals.

I. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.4 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
 2. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.010 inch.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.6 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that project beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Galvanized Steel: Nominal 0.028-inch-thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A653/A653M.
 - 2. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.7 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - 1. Lock Cylinders: As standard with manufacturer and keyed to building keying system.
 - 2. Keys: Three for each cylinder.
- B. Chain Lock Keeper: Suitable for padlock.
- C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s): Operator location indicated for each door.
1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.
1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
1. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
1. Exterior-Mounted Units: Full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 30 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with the accessibility standard.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.
- B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

- C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

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SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior storefront framing.
2. Storefront framing for punched openings.
3. Exterior manual-swing entrance doors and door-frame units.

1.2 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

- B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

- 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

- C. Field quality-control reports.

- D. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 MOCKUPS

- A. Mockups: Build in-place mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

- 1. Build in-place mockup of typical wall area as shown on Drawings.
 - 2. Proceed with construction upon approval of Architect.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 WARRANTY

- A. Special Warranty: Manufacturer and Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.

- 2. Warranty Period: Five years from date of Substantial Completion.

- a. Deterioration of metals and other materials beyond normal weathering.
 - b. Water penetration through fixed glazing and framing areas.
 - c. Failure of operating components.

- 3. Warranty Period: Five years from date of Substantial Completion.

- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of powder coat or organic finishes within specified warranty period.

- 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.

- b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
- D. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 2 for basic protection.
 - 1. Large-Missile Test: For glazing located within 30 feet of grade.
- E. Deflection of Framing Members: At design wind pressure, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
- F. Structural: Test according to ASTM E330/E330M as follows:
 - 1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceed specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- G. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq. ft.
- H. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.3 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - b. Entrance Doors: U-factor of not more than 0.77 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 2. Solar Heat-Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.27 as determined according to NFRC 200.
 - b. Entrance Doors: SHGC of not more than 0.35 as determined according to NFRC 200.
 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested according to ASTM E283.
 - b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 4. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF of 35 frame and 62 glass as determined according to AAMA 1503.
 - b. Entrance Doors: CRF of not less than 63 as determined according to AAMA 1503.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

2.2 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
1. Responsible Sourcing: Recycled content.
 2. Documentation: Material ingredient sourcing, reporting, and optimization.
 3. Documentation: Environmental Product Declarations for Material Ingredients: EPD, HPD, CtoC, Declare.

2.3 SOURCE LIMITATIONS

- A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.
- B. Work of other Sections: Obtain all components of aluminum-framed entrance and storefront system from manufacturer of components for Section 084413 "Glazed Aluminum Curtain Walls."

2.4 STOREFRONT SYSTEMS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide the following YKK AP products:
 - 1. Exterior:
 - a. 50 TU Framing System.
 - b. 35H Door System.
 - 2. Interior:
 - a. YES 45FS Framing System.
 - b. 35 D Door System.
- B. Exterior Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Exterior Framing Construction: Thermally broken.
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: Center.
 - 4. Finish: High-performance organic finish.
 - 5. Fabrication Method: Either factory- or field-fabricated system.
 - 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 7. Steel Reinforcement: As required by manufacturer.
- C. Interior Vestibule and Interior Framing Construction: Non-thermal.
 - 1. Glazing System: Retained mechanically with gaskets on four sides.
 - 2. Glazing Plane: Center.
 - 3. Finish: High performance organic finish.
 - 4. Fabrication Method: Field-fabricated stick system.
 - 5. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
- D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
 - 1. Door Construction: Minimum 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated, and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
 - 2. Door Design: As indicated on Drawings.
 - 3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

- A. Hardware, General: Hardware as approved for use with units tested to meet missile-impact and cyclic-pressure test requirements.
- B. Continuous-Gear Hinges: Stainless-steel bearings between knuckles, fabricated to full height of door and frame.
- C. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.
- D. Weather Stripping: Manufacturer's standard replaceable components.
- E. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- F. Silencers: BHMA A156.16, Grade 1.
- G. Operating Trim: BHMA A156.6.
- H. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.
- I. Entrance Door Hardware: Schedule and balance of hardware as specified in Division 08 Section "Door Hardware."

2.7 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: Comply with Section 088000 "Glazing."
- D. Structural Glazing Sealants: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.
 - 1. Color: As selected by Architect from manufacturer's full range of colors.
- E. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.
 - 1. Color: As selected by Architect from manufacturer's full range of colors.

2.8 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
- D. Structural Profiles: ASTM B308/B308M.

E. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
4. Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

2.9 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.
- E. Rigid PVC Filler: to improve installation of backer rod and perimeter sealant by providing support for backer rod.

2.10 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.11 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Custom color. Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install glazing as specified in Section 088000 "Glazing."
- F. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
- G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2-inch-wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - b. Prepare test and inspection reports.

- C. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 - 1. Test a minimum of two areas on each building facade.
 - 2. Repair installation areas damaged by testing.
- D. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION

SECTION 085313 - VINYL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes fixed and operable vinyl framed windows.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of vinyl window indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, and installation details.
- C. Samples: For each exposed finish.
- D. Product Schedule: Use same designations indicated on Drawings.
- E. Delegated Design Submittals: For reinforcing mullions, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Manufacturer certificates.
- C. Maintenance data.
- D. Delegated Design Engineer Qualifications: For reinforcing mullions.
- E. Sample warranties.

1.4 QUALITY ASSURANCE

- A. Installer: A qualified installer, approved by manufacturer to install manufacturer's products.
- B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the type indicated.
- C. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Provide AAMA-certified vinyl windows with an attached label.
- D. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace vinyl windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of vinyl, other materials, and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 - 2. Warranty Period:
 - a. Window: 10 years from date of Substantial Completion.
 - b. Glazing: 10 years from date of Substantial Completion.
 - c. Vinyl Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design reinforcing mullions.
- B. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Window Certification: FGIA or WDMA certified with label attached to each window.
 - 2. Minimum Performance Class: As indicated by basis of design products.
 - 3. Minimum Performance Grade: As indicated by basis of design products
- C. Structural Performance: Provide vinyl windows capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:
 - 1. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
 - a. Basic Wind Speed: As indicated on structural drawings.
 - b. Importance Factor: 1.0.
 - c. Exposure Category: B.
 - d. Enclosure Classification: Enclosed.
- D. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 3 for basic protection.
 - 1. Large-Missile Test: For glazing located within 30 ft. (9.1 m) of grade.
 - 2. Small-Missile Test: For glazing located more than 30 ft. (9.1 m) above grade.

2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products manufactured by PGT and as follows:
 - 1. PGT HR55 10 Horizontal Roller, Configuration XO.
 - 2. PGT AR5520 Fixed.

2.3 MATERIALS

- A. Vinyl Extrusions: Rigid (unplasticized) hollow PVC extrusions, formulated and extruded for exterior applications, complying with AAMA/WDMA 101/I.S.2/NAFS and the following:
 - 1. PVC Resins: 100 percent virgin resin.
 - 2. PVC Formulation: High impact, low heat buildup, lead free, nonchalking, and color and UV stabilized.
- B. Vinyl Trim and Glazing Stops: Material and finish to match frame members.
- C. Replaceable Weather Seals: Comply with AAMA 701/702.

2.4 WINDOW

- A. Window Type: Horizontal Roller.
 - 1. Basis of Design: PGT HR55 10 Horizontal Roller, Configuration XO.
 - 2. Compliance: AAMA/WDMA 101/I.S.2/NAFS.
 - a. Performance Class and Grade: Meet DP 45.
 - 3. Thermal Transmittance (AAMA 1503):
 - a. U-Factor: 0.29 Btu/sq. ft. x h x deg F or less.
 - 4. Solar Heat-Gain Coefficient (NFRC 200): 0.20 maximum.
 - 5. Visible Light Transmittance: 0.46.
 - 6. Provide Energy Star qualified product for project zone.
 - 7. Water Resistance: (AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test): No water leakage at 20 percent of positive design pressure, but not more than 15 lbf/sq. ft.
- B. Window Type: Fixed.
 - 1. Basis of Design: PGT AR 5520.
 - 2. Compliance: AAMA/WDMA 101/I.S.2/NAFS.
 - a. Performance Class and Grade: Meet DP 45.
 - 3. Thermal Transmittance (AAMA 1503):
 - a. U-Factor: 0.28 Btu/sq. ft. x h x deg F or less.
 - 4. Solar Heat-Gain Coefficient (NFRC 200): 0.17 maximum.
 - 5. Visible Light Transmittance: 0.39.
 - 6. Provide Energy Star qualified product for project zone.

7. Water Resistance: (AAMA/WDMA 101/I.S.2/NAFS, Water Resistance Test): No water leakage at 20 percent of positive design pressure, but not more than 15 lbf/sq. ft.

2.5 GLAZING

- A. Glass: Clear, insulating-glass units, with low-E coating pyrolytic on second surface or sputtered on second surface.
 1. Basis of Design: PGT Energy Shield Max Low-E.
- B. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal and complies with requirements for thermal transmittance.

2.6 HARDWARE

- A. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
 1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.
- B. Horizontal-Sliding Window Hardware:
 1. Sill Cap/Track: Manufacturer's standard, designed to comply with performance requirements indicated and to drain to the exterior.
 2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
 3. Roller Assemblies: Low-friction design.

2.7 ACCESSORIES

- A. Sill Pan Flashing: high-impact 3 piece system with molded corners and interior lip.
 1. Basis-of-Design Product: [Jamsill, Inc.; Jamsill Guard](#).

2.8 FABRICATION

- A. Fabricate vinyl windows that are reglazable without dismantling sash or ventilator framing.
- B. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
- C. Mullions: Provide mullions and cover plates as shown, compatible with window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units. Provide manufacturer's standard finish to match window units.
- D. _____

- E. Factory-Glazed Fabrication: Except for light sizes in excess of 100 united inches, glaze vinyl windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.
- F. Glazing Stops: Provide nailed or snap-on glazing stops coordinated with Division 08 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

2.9 VINYL FINISHES

- A. Integral Finish and Color: Uniform, solid, homogeneous white interior and exterior.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- E. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- F. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- G. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- H. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

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SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Automatic operators.
 - 4. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 01 Section "Closeout Procedures"
 - 2. Division 06 Section "Rough Carpentry".
 - 3. Division 06 Section "Finish Carpentry".
 - 4. Division 08 Section "Operations and Maintenance".
 - 5. Division 08 Section "Door Schedule".
 - 6. Division 08 Section "Door Hardware Schedule".
 - 7. Division 08 Section "Hollow Metal Doors and Frames".
 - 8. Division 08 Section "Flush Wood Doors".
 - 9. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 10. Division 08 Section "Fire-Rated Steel Framed Entrances".
 - 11. Division 08 Section "Automatic Door Operators".
 - 12. Division 28 Section "Access Control Hardware Devices".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.

6. NFPA 105 - Installation of Smoke Door Assemblies.
 7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
 8. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
1. ANSI/BHMA Certified Product Standards - A156 Series.
 2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
 3. ANSI/UL 294 - Access Control System Units.
 4. UL 305 - Panic Hardware.
 5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 - 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Hurricane Resistant Exterior Openings: Provide exterior door hardware as complete and tested assemblies, or component assemblies, including approved doors and frames specified under Section 081113 "Hollow Metal Doors and Frames", to meet the design pressures, debris impact resistance, and glass and glazing requirements applicable to the Project.
 1. Test units according to ASTM E330, ASTM E1886, ASTM E1996, TAS 201, TAS 202, and TAS 203 standards, certified by a qualified independent third party listing agency acceptable to authority having jurisdiction, and bearing a third party certification agency permanent label indicating windstorm approved product.
- G. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 1. Function of building, purpose of each area and degree of security required.
 2. Plans for existing and future key system expansion.
 3. Requirements for key control storage and software.
 4. Installation of permanent keys, cylinder cores and software.
 5. Address and requirements for delivery of keys.
- I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.

2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- J. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
 2. Faulty operation of the hardware.
 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.2 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
5. Manufacturers:
 - a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.3 CONTINUOUS HINGES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 - 1. Where specified, provide modular continuous geared hinges that ship in two or three pieces and form a single continuous hinge upon installation.
 - 2. Manufacturers:
 - a. Pemko (PE).

2.4 SLIDING AND FOLDING HARDWARE

- A. Sliding and Folding Door Hardware: Hardware is to be of type and design as specified and should conform with ANSI/BHMA A156.14.
 - 1. Provide sliding door hardware as follows:
 - a. Sliding Bi-Passing Pocket Door Hardware: Provide complete sets consisting of track, hangers, stops, bumpers, floor channel, guides, and accessories indicated.
 - b. Cascading: Provide a bi-parting or single direction telescoping system as required with a minimum 200 lb. per door capacity.
 - c. Bi-folding Door Hardware: Rated for door panels weighing up to 125 lb.
 - d. Pocket Sliding Door Hardware: Rated for doors weighing up to 200 lb.
 - 2. Manufacturers:
 - a. Pemko (PE).

2.5 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
 - 1. Manufacturers:
 - a. Pemko (PE) - EL-CEPT Series.
 - b. Securitron (SU) - EL-CEPT Series.
- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to

junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:
 - a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
 - b. McKinney (MK) - Connector Hand Tool: QC-R003.
2. Manufacturers:
 - a. McKinney (MK) - QC-C Series.

2.6 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 2. Furnish dust proof strikes for bottom bolts.
 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Rockwood (RO).
- B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
 1. Manufacturers:
 - a. Rockwood (RO).
- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 4. Pulls shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.

5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:
 - a. Rockwood (RO).

2.7 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
 1. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA).
 - b. No Substitution.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Tubular deadlocks and other auxiliary locks.
 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 6. Keyway: Manufacturer's Standard.
- C. Small Format Interchangeable Cores: Provide small format interchangeable cores (SFIC) as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. New System: Key locks to a new key system as directed by the Owner.
- E. Key Quantity: Provide the following minimum number of keys:
 1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).
 3. Construction Keys (where required): Ten (10).
- F. Construction Keying: Provide construction master keyed cylinders.
- G. Construction Keying: Provide temporary keyed construction cores.

H. Key Registration List (Biting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.8 KEY CONTROL

2.9 MORTISE LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 8800FL Series.
 - b. No Substitution.

2.10 CYLINDRICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) 4700LN Series.
 - b. No Substitution.

- B. Cylindrical Indicator Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:
 - a. Visual status indicators in rose, displaying bold visuals for vacant or occupied lock status.
 - b. Meets ANSI/BHMA A156.41 for single motion egress.
 - c. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - d. Three-year limited warranty.
2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - YPL Series.
 - b. No Substitution.

2.11 RESIDENTIAL LOCKING DEVICES

- A. Residential Locking Devices: Provide ANSI A156.2, Series 4000, Grade 2 products (knobs, levers, deadbolts, interconnected, handlesets) as specified.
 - 1. Provide residential locking devices with functions and features as follows:
 - a. Locksets, deadbolts, and handle sets designed to fit ANSI standard door preps.
 - b. Meets UL and ULC Standard 10C Positive Pressure, Fire Test of Door Assemblies.
 - c. Non-handed levers.
 - d. Provide levers of like design and style as specified.
 - 2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - Heritage Series.
 - b. Kwikset (KW) - Signature Series.
 - c. No Substitution.

2.12 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 - 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 - 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 - 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 - 4. Dustproof Strikes: BHMA A156.16.

2.13 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 - 1. Exit devices shall have a five-year warranty.
 - 2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 - 3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper

- fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
 12. Hurricane and Storm Shelter Compliance: Devices to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or storm shelter products that have been independently third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
1. Provide exit devices with functions and features as follows:
 - a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
 - b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
 - c. Meets UL Certification Directory ZHLL.R21744 for products used in windstorm rated assemblies.
 - d. Five-year limited warranty for mechanical features.
 2. Electromechanical exit devices shall have the following functions and features:
 - a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
 - b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.

- c. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
 - d. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.
 - e. Five-year limited warranty for electromechanical features.
 - 3. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 7000 Series.
 - b. No Substitution.
 - C. Conventional Push Rail Exit Devices, Aluminum Entrances: ANSI/BHMA A156.3, Grade 1 panic devices furnished in the functions specified in the Hardware Sets. Push bar to be made of extruded aluminum, maximum projection of 3", available in clad or anodized architectural finishes. Exit device design to fit narrow (minimum 2"), medium, or wide stile aluminum door applications.
 - 1. Manufacturers:
 - a. Adams Rite Manufacturing (AD) - 8000 Series.
 - b. No Substitution.
- 2.14 SURFACE DOOR CLOSERS
- A. All door closers specified herein shall meet or exceed the following criteria:
 - 1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 - 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 - 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 - 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 - 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 - 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
 - B. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.
 - 1. Manufacturers:

- a. ASSA ABLOY ACCENTRA (YA) - Unitrol Series.
 - b. No Substitution.
- C. Door Closers, Surface Mounted (Standard Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
 1. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - 2700 Series.
 - b. No Substitution.

2.15 OVERHEAD CONCEALED DOOR CLOSERS

- A. Door Closers, Overhead Concealed Single Acting (Heavy Duty): Center pivot, single acting ANSI/BHMA 156.4 Grade 1 Certified Products Directory (CPD) listed overhead concealed door closers. Listed manufacturers shall meet all functions and features as specified herein.
 1. Provide overhead concealed doors closers with functions and features as follows:
 - a. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies and A117.1 Accessibility Code.
 - b. Fully concealed body in the frame head and track assembly in the door.
 - c. Separate and independent closing speed and latch speed valves and hydraulic backcheck valve.
 - d. Heavy-duty cast iron body with forged arms and 1-1/4" piston diameter.
 - e. Fifteen-year limited warranty.
 2. Manufacturers:
 - a. Norton Rixson (RF) - 93 Series.

2.16 ELECTROMECHANICAL DOOR OPERATORS

- A. Electromechanical Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that are UL325/991 and UL10C certified and comply with requirements for the Americans with Disabilities Act (ADA). Operators shall accommodate openings up to 250 pounds and 48" wide. Provide accessories such as custom templates, special mounting brackets, spacers and drop plates as needed for proper installation. Operators shall accommodate openings up to 200 pounds and 48" wide. Listed manufacturers shall meet all functions and features as specified herein.
 1. Provide operators with features as follows:
 - a. Non-handed with push and pull side mounting.
 - b. Activation by push button, hands-free or radio frequency devices.
 - c. Adjustable opening force and closing power.

- d. Two-year limited warranty.
 - e. Wi-Fi interface where the operator is a secure, password protected WiFi hot spot with no connection to building's IT required.
 - 1) Simple setup with no app required.
 - 2) View status and make adjustments without removing the cover.
 - 3) Built-in logic to support single use restroom applications with no external relay boards, logic modules, position switches required.
 - f. Mounting backplate to simplify and speed up installation.
 - g. Integration with access control systems.
2. Operators shall have the following functionality:
- a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.
 - b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.
 - c. Emergency Interface Relay: Door closes and ignores any activation input until signal is discontinued.
 - d. Infinite Hold Open: Door will hold open at set position until power is turned off.
 - e. Latch Assist: At closed position, after an activation, the door is pulled in. After the door has closed, the door is pulled in to assist with latch release/engagement.
 - f. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
 - g. Open Delay: Delays operator opening for locking hardware.
 - h. Outside Wall Switch Disable: When contact is closed, outside wall switch is disabled.
 - i. Power Assist: Senses the door is being opened manually and applies small amount of power to assist the user in opening the door with force less than 5 lbs. The door opens only as far as it is moved manually, then closes once released.
 - j. Power Close: Additional force to assist door closing between 7° and 2°.
 - k. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
 - l. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.
 - m. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
 - n. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.
 - o. Executive Mode Feature: When the door receives an activation signal it opens and remains open until either a second signal is received, or the door is manually moved in closing direction.
3. Manufacturers:
- a. Norton Rixson (NO) - 6300 Series.
 - b. No Substitution.

2.17 ELECTROHYDRAULIC DOOR OPERATORS

- A. Electrohydraulic Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that meet ANSI/BHMA A156.4 requirements and are UL listed for use on fire rated doors and UL10C certified that comply with requirements for the Americans with Disabilities Act (ADA). Operators shall be verified by GreenCircle to offer energy savings of 19% when compared to similar products to accommodate openings up to 250 pounds and 48" wide. Provide accessories such as custom templates, special mounting brackets, spacers and drop plates as needed for proper installation. Operators shall accommodate openings up to 200 pounds and 48" wide. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide operators with features as follows:

- a. Non-handed with push and pull side mounting.
- b. Operates as mechanical surface closer during close cycles, when door is opened manually or if power is off.
- c. Activation by push button, hands-free or radio frequency devices.
- d. On board electronics to collect usage and cycle count data to facilitate preventative maintenance/diagnostics.
- e. Two-year limited warranty.
- f. Wi-Fi interface where the operator is a secure, password protected WiFi hot spot with no connection to building's IT required.
 - 1) Simple setup with no app required.
 - 2) View status and make adjustments without removing the cover.
 - 3) Built-in logic to support single use restroom applications with no external relay boards, logic modules, position switches required.
- g. Mounting backplate to simplify and speed up installation.

2. Operators shall have the following functionality:

- a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.
- b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.
- c. Infinite Hold Open: Door will hold open at set position until power is turned off.
- d. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
- e. Open Delay: Delays operator opening for locking hardware.
- f. Overload Safety Shut-Off: After two minutes of receiving a door activation signal, inverter times out and door closes to prevent motor/inverter damage.
- g. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
- h. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.
- i. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.

- j. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.

3. Manufacturers:

- a. Norton Rixson (NO) - 6000 Series.
- b. No Substitution.

2.18 ARCHITECTURAL TRIM AND ACCESSORIES

A. Door Protective Trim:

- 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
- 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
- 3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
- 4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
- 5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
- 6. Manufacturers:
 - a. Rockwood (RO).

2.19 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 - 1. Manufacturers:
 - a. Rockwood (RO).

2.20 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. Pemko (PE).

2.21 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
 - 1. Manufacturers:
 - a. Securitron (SU) - DPS Series.
- B. Intelligent Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
 - 1. Power supplies shall meet all functions and features as specified herein.
 - a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.

- b. Dedicated fast charger to prolong battery life with low battery cutoff to protect batteries from deep discharge.
- c. Enhanced surge immunity for input/output protection
- d. Separate, dedicated battery charging circuit to keep locks cooler.
- e. Dual-color LED visual notification to prevent applying incorrect voltages to the power supply.
- f. Instant auto-switch to battery on AC loss.
- g. Expandable up to 16 outputs in the standard enclosure
- h. Integrated fire alarm interface to allow main output shutdown or disconnect on a per output basis when using an R8 output module.
- i. Network ready and remotely manage locks and connected devices when using an M8 managed output module on network models.
- j. Lifetime replacement, no-fault, no questions asked warranty.

2. Manufacturers:

- a. Securitron (SU) - AQL Series.

2.22 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.23 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.6 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.7 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.
 - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

- B. Manufacturer's Abbreviations:

- 1. MK - McKinney
- 2. PE - Pemko
- 3. SU - Securitron
- 4. RO - Rockwood
- 5. YA - ASSA ABLOY ACCENTRA
- 6. KW - Kwikset
- 7. AD - Adams Rite
- 8. RF - Rixson
- 9. NO - Norton
- 10. DR - DoorBird
- 11. CI - Control iD

Hardware Sets**Set: 1.0**

Doors: X101

Description: EXT PR - ALUM - MAIN LOBBY [CARD READER]

2 Continuous Hinge	CFM SLF-HD1 PT x Length Required		PE	087100	
2 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Concealed Vert Rod Exit	8600 MLR M1 MEC-US32D ELX	US32D	AD	087100	⚡
1 Concealed Vert Rod Exit	8600 M1 MEC-US32D ELX	US32D	AD	087100	⚡
1 Exit Device Trim	8650	US32D	AD	087100	
1 SFIC Core	A600	626	YA	087100	
1 Mortise Housing	K660	626	YA	087100	
2 Offset Pull	RM5277 12 x 12HD	US32D	RO	087100	
2 Surface Closer	UNI4400	689	YA	087100	
2 Sweep	3452CNB		PE	087100	
1 Threshold	25_x_AFG MSES25SS-2		PE	087100	
2 ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
2 ElectroLynx Harness - Door	QC-CXXX (Size as required)		MK	087100	⚡
2 Position Switch	DPS-M/W-WH		SU	087100	⚡
1 Card Reader + Keypad / Updater	NTX752K-UPDTR-TS		YA	281500	
1 Power Supply	PS-EXIT		AD	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified				
1 Gasket	Furnished with Aluminum Door/Frame				

Notes: Operational Narrative:

1. Doors normally closed and secure.
 2. Authorized access by card reader retracting exit device latch for predetermined time limit. Exit device latch can be electrically held retracted for open access.
 3. Egress free for immediate exit.
 4. REX switch in push rail allows authorized exit without alarm condition.
 5. Door position switch monitor open/closed status.
 6. Exit device latch releases (fail secure) in event of power loss. Keyed cylinder override for emergency access.
- ACCENTRA controller and power supply included in miscellaneous hardware set at end of schedule.

Set: 2.0

Doors: X100

Description: EXT PR - ALUM - LOBBY [CARD READER, AUTO OPERATOR]

2 Continuous Hinge	CFM_SLF-HD1 PT x Length Required		PE	087100	
2 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Concealed Vert Rod Exit	8600 MLR M1 MEC-US32D ELX	US32D	AD	087100	⚡
1 Concealed Vert Rod Exit	8600 M1 MEC-US32D ELX	US32D	AD	087100	⚡
1 Exit Device Trim	8650	US32D	AD	087100	
1 SFIC Core	A600	626	YA	087100	
1 Mortise Housing	K660	626	YA	087100	
2 Offset Pull	RM5277 12 x 12HD	US32D	RO	087100	
2 Automatic Opener	6331	689	NO	087100	⚡
2 Sweep	3452CNB		PE	087100	
1 Threshold	25_x_AFG MSES25SS-2		PE	087100	
2 ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
2 ElectroLynx Harness - Door	QC-CXXX (Size as required)		MK	087100	⚡
1 Video Door Intercom Station	DoorBird D31TD Series		DR	281523	⚡
2 Actuator Wall Switch	700		NO	087100	⚡
2 Position Switch	DPS-M/W-WH		SU	087100	⚡
1 Card Reader + Keypad / Updater	NTX752K-UPDTR-TS		YA	281500	
1 Power Supply	PS-EXIT		AD	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified				
1 Gasket	Furnished with Aluminum Door/Frame				

Notes: Operational Narrative:

1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latch for predetermined time limit. Exit device latch can be electrically held retracted for open access.
3. ADA access by actuator switch. In locked condition, actuator energized only upon valid card reader presentation.
4. Egress free for immediate exit. ADA egress by actuator switch.
5. REX switch in push rail allows authorized exit without alarm condition.
6. Door position switch monitor open/closed status.
7. Exit device latch releases (fail secure) in event of power loss. Keyed cylinder override for emergency access.

ACCENTRA controller and power supply included in miscellaneous hardware set at end of schedule.

Set: 3.0

Doors: X107, X131

Description: EXT SGL - ALUM - FITNESS, COMMUNITY ROOM [CARD READER]

1 Continuous Hinge	CFM_SLF-HD1 PT x Length Required		PE	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Rim Exit Device	P8800 MLR M1 MEC-US32D ELX	US32D	AD	087100	⚡
1 Exit Device Trim	8650	US32D	AD	087100	
1 SFIC Core	A600	626	YA	087100	
1 Rim Housing	K680	626	YA	087100	
1 Offset Pull	RM5277 12 x 12HD	US32D	RO	087100	
1 Surface Closer	UNI4400	689	YA	087100	
1 Sweep	3452CNB		PE	087100	
1 Threshold	25_x_AFG MSES25SS-2		PE	087100	
1 ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
1 ElectroLynx Harness - Door	QC-CXXX (Size as required)		MK	087100	⚡
1 Card Reader + Keypad / Updater	NTX752K-UPDTR-TS		YA	281500	
1 Power Supply	PS-EXIT		AD	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified				
1 Gasket	Furnished with Aluminum Door/Frame				

Notes: Operational Narrative:

1. Doors normally closed and secure.
 2. Authorized access by card reader retracting latch, allowing for authorized entry.
 3. Egress free for immediate exit.
 4. REX switch in push rail allows authorized exit without alarm condition.
 5. Door position switch monitor open/closed status.
 6. Exit device lever remains locked (fail secure) in event of power loss. Keyed cylinder override for emergency access.
- ACCENTRA controller and power supply included in miscellaneous hardware set at end of schedule.

Set: 4.0

Doors: X161.1, X161.2, X162, X163, X164, X166.1, X166.2

Description: EXT PR - ALUM - RETAIL

2 Continuous Hinge	CFM_SLF-HD1-M x Length Required		PE	087100	
2 Concealed Vert Rod - Exit Only	8600 MEC-US32D	US32D	AD	087100	
1 Exit Device Trim	8650	US32D	AD	087100	
1 SFIC Core	A600	626	YA	087100	
1 Mortise Housing	K660	626	YA	087100	
2 Offset Pull	RM5277 12 x 12HD	US32D	RO	087100	
2 Surface Closer	UNI4400	689	YA	087100	
2 Sweep	3452CNB		PE	087100	

1 Threshold	25_x_AFG MSES25SS-2	PE 087100
1 Gasket	Furnished with Aluminum Door/Frame	

Set: 5.0

Doors: X185

Description: EXT PR - SERVICE LOBBY [CARD READER, AUTO OPERATOR]

2 Continuous Hinge	CFM_HD1 PT x Length Required	PE 087100
2 Electric Power Transfer	EL-CEPT 630	SU 087100 ⚡
1 Concealed Vert Rod Exit, Dummy Trim	7220M B MELR TB509F 630	YA 087100 ⚡
1 Concealed Vert Rod Exit, Classroom	7220M B MELR TB506F K680 630	YA 087100 ⚡
1 SFIC Core	A600 626	YA 087100
2 Automatic Opener	D6011 689	NO 087100 ⚡
2 Kick Plate	K1050 10" high CSK BEV US32D	RO 087100
2 Astragal	29324CNB	PE 087100
1 Gasketing	290APK x 2891APK	PE 087100
2 Sweep	3452CNB	PE 087100
1 Threshold	25_x_AFG MSES25SS-2	PE 087100
2 ElectroLynx Harness - Frame	QC-C1500P	MK 087100 ⚡
2 ElectroLynx Harness - Door	QC-CXXX (Size as required)	MK 087100 ⚡
2 Actuator Wall Switch	700	NO 087100 ⚡
2 Position Switch	DPS-M/W-WH	SU 087100 ⚡
1 Card Reader + Keypad / Updater	NTX752K-UPDTR-TS	YA 281500
1 Power Supply	AQL series	SU 087100 ⚡
1 Wiring Diagram	Elevation and Point to Point as Specified	

Notes: Operational Narrative:

1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latches for predetermined time limit. Exit device latches can be electrically held retracted for open access.
3. ADA access by actuator switch. In locked condition, actuator energized only upon valid card reader presentation.
4. Egress free for immediate exit. ADA egress by actuator switch.
5. REX switch in push rail allows authorized exit without alarm condition.
6. Door position switches monitor open/closed status.
7. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

ACCENTRA controller and power supply included in miscellaneous hardware set at end of schedule.

Set: 6.0Doors: [X137](#), [X195](#)

Description: EXT PR - STOR

2 Continuous Hinge	CFM_HD1-M x Length Required	PE	087100
1 Self Latch Flush Bolt Set	2845 / 2945 (as required)	US26D RO	087100
1 Storeroom or Closet Lock	TBR3 8805RL A620 Less Core	626 YA	087100
1 SFIC Core	A600	626 YA	087100
1 Coordinator	2600 Series x Mtng Brackets as required	Black RO	087100
2 Surface Closer	UNI4400	689 YA	087100
2 Kick Plate	K1050 10" high CSK BEV	US32D RO	087100
2 Astragal	29324CNB	PE	087100
1 Gasketing	290APK x 2891APK	PE	087100
2 Sweep	3452CNB	PE	087100
1 Threshold	25_x_AFG MSES25SS-2	PE	087100

Set: 7.0Doors: [X136](#), [X196](#)

Description: EXT SGL - MAIN ELEC

1 Continuous Hinge	CFM_HD1-M x Length Required	PE	087100
1 Rim Exit Device, Nightlatch	7100 TB627F K680	630 YA	087100
1 SFIC Core	A600	626 YA	087100
1 Surface Closer	UNI4400	689 YA	087100
1 Gasketing	290APK x 2891APK	PE	087100
1 Sweep	3452CNB	PE	087100
1 Threshold	25_x_AFG MSES25SS-2	PE	087100

Set: 8.0Doors: [X139](#), [X160](#), [X200](#)

Description: EXT SGL - CORRIDOR, STAIR

1 Continuous Hinge	CFM_HD1-M x Length Required	PE	087100
1 Rim Exit Device, Nightlatch	7100 TB627F K680	630 YA	087100
1 SFIC Core	A600	626 YA	087100
1 Surface Closer	UNI4400	689 YA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D RO	087100
1 Gasketing	290APK x 2891APK	PE	087100
1 Sweep	3452CNB	PE	087100
1 Threshold	25_x_AFG MSES25SS-2	PE	087100

Set: 9.0Doors: [X194](#)

Description: EXT SGL - LOADING [CARD READER]

1 Continuous Hinge	CFM_HD1 PT x Length Required		PE	087100	
1 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡
1 Rim Exit Device, Nightlatch	7100 B MELR TB627F K680	630	YA	087100	⚡
1 SFIC Core	A600	626	YA	087100	
1 Surface Closer	UNI4400	689	YA	087100	
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100	
1 Gasketing	290APK x 2891APK		PE	087100	
1 Sweep	3452CNB		PE	087100	
1 Threshold	25_x_AFG MSES25SS-2		PE	087100	
1 ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
1 ElectroLynx Harness - Door	QC-CXXX (Size as required)		MK	087100	⚡
1 Card Reader / Updater	NTX712-UPDTR-PT		YA	281500	⚡
1 Position Switch	DPS-M/W-WH		SU	087100	⚡
1 Power Supply	AQL series		SU	087100	⚡

Set: 10.0Doors: [X135](#), [X161.3](#)

Description: EXT SGL - FIRE PUMP, RETAIL

1 Continuous Hinge	CFM_HD1-M x Length Required		PE	087100	
1 Storeroom or Closet Lock	TBR3 8805RL A620 Less Core	626	YA	087100	
1 SFIC Core	A600	626	YA	087100	
1 Surface Closer	UNI4400	689	YA	087100	
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100	
1 Gasketing	290APK x 2891APK		PE	087100	
1 Sweep	3452CNB		PE	087100	
1 Threshold	25_x_AFG MSES25SS-2		PE	087100	

Set: 11.0

Doors: 101

Description: PR - ALUM - MAIN LOBBY [CARD READER, AUTO OPERATOR]

2 Continuous Hinge	CFM_SLF-HD1 PT x Length Required		PE	087100	
2 Electric Power Transfer	EL-CEPT	630	SU	087100	⚡

1 Concealed Vert Rod Exit	8600 MLR M1 MEC-US32D ELX	US32D	AD	087100	⚡
1 Concealed Vert Rod Exit	8600 M1 MEC-US32D ELX	US32D	AD	087100	⚡
1 Exit Device Trim	8650	US32D	AD	087100	
1 SFIC Core	A600	626	YA	087100	
1 Mortise Housing	K660	626	YA	087100	
2 Offset Pull	RM5277 12 x 12HD	US32D	RO	087100	
2 Automatic Opener	6331	689	NO	087100	⚡
2 ElectroLynx Harness - Frame	QC-C1500P		MK	087100	⚡
2 ElectroLynx Harness - Door	QC-CXXX (Size as required)		MK	087100	⚡
1 Video Door Intercom Station	DoorBird D31TD Series		DR	281523	⚡
2 Actuator Wall Switch	700		NO	087100	⚡
2 Position Switch	DPS-M/W-WH		SU	087100	⚡
1 Card Reader + Keypad / Updater	NTX752K-UPDTR-TS		YA	281500	
1 Power Supply	PS-EXIT		AD	087100	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified				
1 Gasket	Furnished with Aluminum Door/Frame				

Set: 12.0

Doors: 106.1, 204, 403

Description: SGL - ALUM - YOGA, MEETING ROOM

1 Continuous Hinge	CFM_SLF-HD1-M x Length Required		PE	087100	
1 Pull	RM5275-12 Mtg-Type 1	US32D	RO	087100	
1 Push Bar	RM5232	US32D	RO	087100	
1 Concealed Closer	93N	689	RF	087100	
1 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100	

Set: 14.0

Doors: 285, 385, 485

Description: PR - RATED - SE LOBBY

8 Hinge, Full Mortise, Hvy Wt	T4A3786 [NRP]	US26D	MK	087100	
1 Dust Proof Strike	570	US26D	RO	087100	
1 Self Latch Flush Bolt Set	2845 / 2945 (as required)	US26D	RO	087100	
1 Classroom Lock	B TB 4708LN	626	YA	087100	
1 SFIC Core	A600	626	YA	087100	
1 Coordinator	2600 Series x Mtng Brackets as required	Black	RO	087100	

2 Surface Closer	2701 / P2701	689	YA	087100
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
2 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100
1 Astragal	S771C		PE	087100
1 Gasketing	S88D (Head & Jambs)		PE	087100

Set: 15.0

Doors: 101.1, 307.1, 307.2

Description: PR - STORAGE

8 Hinge, Full Mortise	TA2714 [NRP]	US26D	MK	087100
1 Dust Proof Strike	570	US26D	RO	087100
2 Flush Bolt	555 / 557 (As Required)	US26D	RO	087100
1 Classroom Lock	B TB 4708LN	626	YA	087100
1 SFIC Core	A600	626	YA	087100
2 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100
2 Silencer	608-RKW		RO	087100

Set: 16.0

Doors: 103, 105.1, 123, 131

Description: SGL - RATED - DATA [CARD READER]

4 Hinge, Full Mortise, Hvy Wt	T4A3786 [NRP]	US26D	MK	087100
1 Access Control Cyl Lock	B TB NTB623-ACC	626	YA	281500 ⚡
1 SFIC Core	A600	626	YA	087100
1 Surface Closer	2701 / P2701	689	YA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100
1 Gasketing	S88D (Head & Jambs)		PE	087100

Notes: Operation:

1. Door normally closed and secured.
2. Presentation of valid credentials or mechanical key override unlocks trim allowing entry.
3. Loss of power door to remain locked.
4. Always free egress.

Set: 17.0

Doors: 109, 110, 139, 157, 160, 209, 210, 239, 240, 257, 260, 286, 309, 310, 339, 340, 357, 360, 386, 409, 410, 439, 440, 457, 460, 486

Description: SGL - RATED - CORRIDOR, STAIR

4 Hinge, Full Mortise, Hvy Wt	T4A3786 [NRP]	US26D	MK	087100
1 Fire Rated Rim Exit, Passage	7100F TB628F	630	YA	087100
1 Surface Closer	2701 / P2701	689	YA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100
1 Gasketing	S88D (Head & Jambs)		PE	087100
1 Sweep	315CN		PE	087100

Set: 18.0

Doors: 103.4, 104.2, 129, 202

Description: SGL - STORAGE

4 Hinge, Full Mortise	TA2714 [NRP]	US26D	MK	087100
1 Storeroom Lock	B TB 4705LN	626	YA	087100
1 SFIC Core	A600	626	YA	087100
1 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100
3 Silencer	608-RKW		RO	087100

Set: 19.0

Description: SGL - STORAGE

4 Hinge, Full Mortise	TA2714 [NRP]	US26D	MK	087100
1 Storeroom Lock	B TB 4705LN	626	YA	087100
1 SFIC Core	A600	626	YA	087100
1 Surface Closer	2701 / P2701	689	YA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100
3 Silencer	608-RKW		RO	087100

Set: 20.0

Doors: 125.1, 125.2, 134, 138, 223, 225.1, 225.2, 258, 259, 276, 323, 325.1, 325.2, 358, 359, 376, 423, 425.1, 425.2, 458, 459, 476

Description: SGL - RATED - MECH, AV, ELEC, STOR

4 Hinge, Full Mortise	TA2714 [NRP]	US26D	MK	087100
1 Storeroom Lock	B TB 4705LN	626	YA	087100
1 SFIC Core	A600	626	YA	087100
1 Surface Closer	2701 / P2701	689	YA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100
1 Gasketing	S88D (Head & Jambs)		PE	087100

Set: 21.0

Doors: 103.3, 104.1, 106, 107.1, 205, 206, 207, 303, 304, 305, 404, 405

Description: SGL - OFFICE, MEETING ROOM, VIRTUAL ROOM

4 Hinge, Full Mortise	TA2714 [NRP]	US26D	MK	087100
1 Entry Lock	B TB 4707LN	626	YA	087100
1 SFIC Core	A600	626	YA	087100
1 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100
3 Silencer	608-RKW		RO	087100

Set: 22.0

Doors: 401

Description: SGL - THEATRE ROOM

4 Hinge, Full Mortise	TA2714 [NRP]	US26D	MK	087100
1 Classroom Lock	B TB 4708LN	626	YA	087100
1 SFIC Core	A600	626	YA	087100
1 Surface Closer	2701 / P2701	689	YA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100
1 Acoustic Seal Set	PEMKOSTCSET-3A	BL	PE	087100

Set: 23.0

Doors: 301

Description: SGL - RENTABLE STORAGE

4 Hinge, Full Mortise	TA2714 [NRP]	US26D	MK	087100
1 Classroom Lock	B TB 4708LN	626	YA	087100
1 SFIC Core	A600	626	YA	087100
1 Surface Closer	2701 / P2701	689	YA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100
3 Silencer	608-RKW		RO	087100

Set: 24.0

Doors: 278, 378, 478

Description: SGL - RATED - JAN

4 Hinge, Full Mortise	TA2714 [NRP]	US26D	MK	087100
1 Classroom Lock	B TB 4708LN	626	YA	087100

1 SFIC Core	A600	626	YA	087100
1 Surface Closer	2701 / P2701	689	YA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100
1 Gasketing	S88D (Head & Jambs)		PE	087100

Set: 25.0Doors: [102.1](#), [102.2](#), [102.3](#), [104](#), [108](#), [133](#)

Description: SGL - TOILET

4 Hinge, Full Mortise	TA2714 [NRP]	US26D	MK	087100
1 Privacy	TB YPL02	626	YA	087100
1 Surface Closer	2701 / P2701	689	YA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100
3 Silencer	608-RKW		RO	087100
1 Coat Hook	RM817	US15	RO	087100

Set: 26.0Doors: [284](#), [384](#), [484](#)

Description: SGL - RATED - TRASH

4 Hinge, Full Mortise	TA2714 [NRP]	US26D	MK	087100
1 Passage Latch	TB 4701LN	626	YA	087100
1 Surface Closer	2701 / P2701	689	YA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100
1 Door Stop	409 (or) 441CU (As Required)	US32D	RO	087100
1 Gasketing	S88D (Head & Jambs)		PE	087100

Set: 27.0Doors: [A](#)

Description: UNIT ENTRY

3 Hinge, Full Mortise	TA2714 [NRP]	US26D	MK	087100
1 Passage Lock	725HFL RDT 26D 6AL RCS		KW	087100
1 Deadbolt	D212 B	626	YA	087100
1 SFIC Core	A600	626	YA	087100
1 Surface Closer	2701 / P2701	689	YA	087100
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO	087100

1 Door Stop	RM857	US15	RO	087100
1 Gasketing	S88D (Head & Jambs)		PE	087100
1 Door Bottom	3692APK773BL		PE	087100
1 Threshold	171A MSES25SS		PE	087100
1 Viewer	627	CRM	RO	087100

Set: 28.0

Doors: DR47

Description: UNIT A/C

3 Hinges	Furnished with Pre-Hung Door	US26D		
1 Deadbolt	660RDT 26D SMT RCAL RCS/5303 K3		KW	087100
1 Door Stop	518	US26D	RO	087100
1 Hinge Stop	76306 (where door stop cannot be used)	US26D	MK	087100
3 Silencer	608-RKW		RO	087100

Set: 29.0

Doors: B, C, D

Description: UNIT BED/BATH

3 Hinges	Furnished with Pre-Hung Door	US26D		
1 Privacy Lock	730HFL RDT 26D 6AL RCS		KW	087100
1 Door Stop	518	US26D	RO	087100
1 Hinge Stop	76306 (where door stop cannot be used)	US26D	MK	087100

Set: 30.0

Doors: E

Description: UNIT CLOSET - BIFOLD

1 BiFold Door Hdwe	HF4/100A		PE	087100
2 Pull	853	US32D	RO	087100

Set: 31.0

Doors: X168

Description: OVERHEAD DOOR - TRASH

1 Hardware	All Hardware Supplied by Assembly Mnfr.

Set: 32.0

Doors: MISC

Description: PARKING GATE READER

1 Parking Gate Reader

iDUHF

CI 281500 ⚡

END OF SECTION 087100

SECTION 088000 - GLAZING

1.1 SUMMARY

A. Section includes:

1. Glass for windows, doors, interior borrowed lites, storefront framing, including:
 - a. Annealed float glass.
 - b. Tempered glass.
 - c. Laminated glass.
 - d. Fore protective glass.
2. Glazing sealants and accessories.

B. Related Requirements:

1. Section 088813 "Fire Resistant Glazing."

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include principal center-of-glass performance metrics for each exterior glazing unit type.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Florida Building Code Approvals: Provide Florida Product Approval (FPA) from Florida Department of Business & Professional Regulation or Miami-Dade County Notice of Acceptance (NOA) stating glazed openings comply with Code requirements for resistance to impact from wind-borne debris.
- B. Qualification Data: For Installer and manufacturers of insulating-glass units with sputter-coated, low-E coatings.
- C. Product Certificates: For glass.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Mockups: Build in-place mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts," to match glazing systems required for Project, including glazing methods.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than four Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 5 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.

2.2 MANUFACTURERS

- A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.3 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Importance Factor: 1.0.
 - 3. Exposure Category: C.
 - 4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - 5. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Windborne-Debris-Impact Resistance: Exterior glazing shall comply with basic-protection testing requirements in ASTM E 1996 for Wind Zone 3 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.
 - 1. Large-Missile Test.
- E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For laminated glass lites, properties are based on products of construction indicated.
 - 2. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 - 3. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - 4. Visible Reflectance: Center-of-glazing values, according to NFRC 300.
- G. Color Variation of Coated Glass: Provide vacuum deposition coatings on glass complying with color variation limits specified in ASTM C 1376.

2.4 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 - 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 - 1. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.5 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.6 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.
- B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with the following to comply with interlayer manufacturer's written instructions:
1. Polyvinyl butyral interlayer.

2.7 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and shall comply with NFPA 80.
1. Description: Two plies of clear, ceramic glass; 8-mm total thickness; laminated; complying with 16 CFR 1201, Category II.
- B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test; whether glazing meets 450 deg F temperature-rise limitation; and fire-resistance rating in minutes.
1. Basis of Design Fire-Protection-Rated Laminated Ceramic Glazing: Laminated glass manufactured by SafliFirst and as follows:
 - a. 20 Minute Rated Fire Protective Safety Glazing: SuperLite I.
 - b. 45 Minute Rated Fire Protective Safety Glazing: SuperClear 45 HS.
 - c. 60 Minute Rated Fire Protective Safety Glazing: SuperLite X-60.
 2. Subject to compliance with requirements, other acceptable manufacturers include:
 - a. Technical Glass Products.
 - b. Vetrotech St. Gobain.

2.8 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190. Provide insulating glass units free of skips or voids in the primary or secondary seals. Utilize an automated vertical insulating line for insulating glass unit assembly, sealing, and curing processes.
1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary sealants.
 2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
 3. Desiccant: Molecular sieve or silica gel, or a blend of both.
 4. Edge Deletion: Delete low-E coating prior to fabrication of insulating units according to coated glass manufacturer's instructions.

2.9 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealant shall have a VOC content of 250 g/L or less.
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

1. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

C. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT. SWRI validation certificate.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; 890NST.
 - b. Sika USA; SikaSil WS-290.
 - c. The Dow Chemical Company; DOWSIL 795 Silicone Building Sealant.
 - d. Tremco Incorporated; Spectrem 1.

2. Applications: Metal-to metal and glass-to-metal.

D. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT. SWRI validation certificate.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; 864NST; 895NST 896.
 - b. Sika USA; SikaSil WS-295; WS-295 FPS.
 - c. The Dow Chemical Company; DOWSIL 795 Silicone Building Sealant.
 - d. Tremco Incorporated; Spectrem 2; Spectrem 3.

2. Applications: Metal-to metal and glass-to-metal; metal frames to perimeter cladding.

E. Neutral-Curing Silicone Glazing Sealant, Class 50, Non-Staining: Complying with ASTM C920, Type S, Grade NS, Use NT. SWRI validation certificate.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; 864NST; 895NST.
 - b. Sika USA; SikaSil WS-295; WS-295 FPS.

- c. The Dow Chemical Company; DOWSIL 795 Silicone Building Sealant.
- d. Tremco Incorporated; Spectrem 2; Spectrem 3.

- 2. Applications: Metal-to metal and glass-to-metal; metal frames to perimeter cladding where perimeter materials may be absorbant.

2.10 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.11 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.12 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

- a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.
- C. Examine fire-protection rated glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Instal exterior glazing in accordance with the FPA or NOA, as submitted, the manufacturer's written instructions and approved Shop Drawings.
- B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape where fixed stop is indicated for exterior glazing.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

- A. Glass Type GL-03T: Clear fully tempered float glass.
 - 1. Minimum Thickness: 6 mm.
 - 2. Safety glazing label required.
 - 3. Application: Interior glazing where safety glazing is required.

3.9 LAMINATED GLASS SCHEDULE

- A. Glass Type GL-02T: Low-E-coated, clear laminated glass, windborne-debris-impact-resistant.

1. Single Lite: Two plies of fully tempered float glass.
 - a. Minimum Thickness of Each Glass Ply: 6 mm, and as required to meet performance requirements.
 - b. Low-E Coating: Sputtered on second surface.
 - c. Basis of Design Product: Guardian Industries, Inc., SunGuard SN 68 on Clear.
 - d. Minimum Thickness of Interlayer: 0.060 inch (1.52 mm), and as required to meet performance requirements.
2. Safety glazing label where required.
3. Application: Aluminum entry doors.

3.10 INSULATING-LAMINATED-GLASS SCHEDULE

- A. Glass Type GL-01T: Low-E-coated, clear insulating laminated glass, windborne-debris-impact-resistant.
 1. Outdoor Lite: Fully tempered float glass.
 - a. Minimum Thickness of Outdoor Glass Lite: 6 mm.
 - b. Low-E Coating: Sputtered on second surface.
 - c. Basis of Design Product: Guardian Industries, Inc., SunGuard SN 68 on Clear.
 2. Interspace Content: Air.
 3. Indoor Lite: Two plies of fully tempered float glass.
 - a. Minimum Thickness of Each Glass Ply: 5 mm, and as required to meet performance requirements.
 - b. Minimum Thickness of Interlayer: 0.060 inch (1.52 mm), and as required to meet performance requirements.
 4. Winter Nighttime U-Value: 0.28.
 5. Visible Light Transmittance: 65 percent minimum.
 6. Solar Heat Gain Coefficient: 0.37 maximum.
 7. Outdoor Visible Light Reflectance: 11 percent maximum.
 8. Safety glazing label where required.

3.11 FIRE PROTECTIVE RATED GLASS SCHEDULE

- A. GL-D-20: 20 Minute Rated Fire Protective Safety Glass.
- B. GL-D-H-OH-20: 20 Minute Rated Fire Protective Safety Door And Sidelite Glass.
- C. GL-D-H-45: 45 Minute Rated Fire Protective Safety Glass.
- D. GL-D-H-OH-45: 45 Minute Rated Fire Protective Safety Door And Sidelite Glass.
- E. GL-D-H-60: 60 Minute Rated Fire Protective Safety Glass.

END OF SECTION

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following types of silvered flat glass mirrors:

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.
- D. Samples: For each type of the following:
 - 1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
 - 2. Mirror Trim: 12 inches long.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants: For products located inside the weather barrier.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Guardian Glass; SunGuard.
 - 2. Pilkington.
 - 3. AGC.
- B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- C. Source Limitations for Mirror Accessories: Obtain mirror-glazing accessories from single source.

2.3 SILVERED FLAT GLASS MIRRORS

- A. Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
- B. Annealed Monolithic Glass Mirrors: Mirror Quality, clear.
 - 1. Nominal Thickness: 4.0 mm.

2.4 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

2.5 MIRROR HARDWARE

- A. Aluminum J-Channels and Cleat: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
 - 1. Bottom and Top Trim: J-channels formed with front leg and back leg not less than 5/16 and 3/4 inch in height, respectively.
 - 2. Finish: Clear bright anodized.
- B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.6 FABRICATION

- A. Fabricate mirrors in the shop to greatest extent possible.
- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
 - 1. GANA Publications: "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

- C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 1. Aluminum J-Channels: Provide setting blocks 1/8-inch-thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4-inch-wide by 3/8-inch-long at bottom channel.
 - 2. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION

SECTION 088813 - FIRE-RESISTANT GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire-resistance-rated glazing.
- B. Related Requirements:
 - 1. Section 088000 "Glazing."

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product; 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For installers.
- B. Product Certificates: For each type of glass and glazing product, from manufacturer.
- C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Logo: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, manufacture, testing laboratory (UL), fire rating period, safety glazing standards, and date of manufacture.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during the remainder of the construction period.

1.9 WARRANTY

- A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

- B. Safety Glazing Labeling: Permanently mark glazing with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.4 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
 - 2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.

2.5 FIRE-RESISTANCE-RATED GLAZING

- A. Fire-Resistance-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-resistance ratings indicated, based on testing according to ASTM E 119 or UL 263.
- B. Fire-Resistance-Rated Glazing Labeling: Permanently mark fire-resistance-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, that the glazing is approved for use in walls, and the fire-resistance rating in minutes.
- C. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, ultraclear float glass; with intumescent interlayers; and complying with 16 CFR 1201, Category II.
 - 1. Basis of Design: Fire-resistant glass manufactured by SaftiFirst and as follows:
 - a. 90 Minute Rated Fire Resistant Safety Door Glazing: SuperLite II-XL 90.
 - b. 120 Minute Fire Resistant Safety Sidelite & Transom Glazing: SuperLite II-XL 120.
 - 2. Subject to compliance with requirements, other acceptable manufacturers include:
 - a. AGC Glass Company North America, Inc.
 - b. Technical Glass Products.
 - c. Vetrotech Saint-Gobain.

2.6 GLAZING ACCESSORIES

- A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and

glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.

1. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

- C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- C. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.8 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial washaway from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
 - C. Remove and replace glass that is damaged during construction period.
 - D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.
- 3.8 FIRE-RESISTANCE-RATED GLAZING SCHEDULE
- A. Glass Type GL-D-H-W-90: 90 Minute Rated Fire Resistant Safety Door Glazing.
 - B. Glass Type GL-H-OH-W-120: 120 Minute Fire Resistant Safety Sidelite & Transom Glazing

END OF SECTION

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SECTION 090561 - MOISTURE VAPOR EMISSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fluid-applied, resin-based, membrane-forming systems that control the moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for floor covering installation.

1.2 ALLOWANCES

- A. Concrete MVE-control systems are part of Moisture Vapor Emission Control Allowance.

1.3 UNIT PRICES

- A. Work of this Section is affected by Moisture Vapor Emission Control Unit Price.

1.4 DEFINITIONS

- A. MVE: Moisture vapor emission.
- B. MVER: Moisture vapor emission rate.

1.5 ACTION SUBMITTALS

- A. Product Data: for each type of product.
- B. Sustainable Design Submittals: Submit documentation for applicable categories based upon requirements of Section 018113 Sustainable Design Requirements:
1. Product Data: for paints and coatings indicating compliance with General Emissions evaluation and VOC content requirements.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: for Installer.
- B. Product Test Reports: for each MVE-control system, for tests performed by a qualified testing agency.
- C. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Comply with MVE-control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.
 - 1. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE-control system manufacturer, but not less than 65 deg F or more than 85 deg F and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
 - 2. Install MVE-control systems where concrete surface temperatures will remain a minimum of 5 deg F higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:
 - 1. MVER: Maximum 15 lb of water/1000 sq. ft. when tested according to ASTM F1869.
 - 2. Relative Humidity: Maximum 100 percent when tested according to ASTM F2170 using in situ probes.
- B. Water-Vapor Transmission: Through MVE-control system, maximum 0.06 perm when tested according to ASTM E96/E96M.
- C. Tensile Bond Strength: for MVE-control system, greater than 200 psi with failure in the concrete according to ASTM D7234.

2.2 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Low-Emitting Materials: Field applied interior paints and coatings.
 - 3. Low-Emitting Materials: Flooring.
 - 4. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.3 MVE-CONTROL SYSTEM

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

1. ARDEX Americas; ARDEX MC™ RAPID One-Coat Moisture Control System for Concrete to Receive ARDEX Products.
 2. Custom Building Products; CustomTech™ TechMVC™ 100% Solids Epoxy Moisture Vapor Control.
 3. KOSTER American Corporation; VAP I 2000 UFS.
 4. LATICRETE SUPERCAP, LLC; Supercap Moisture Vapor Control.
 5. MAPEI Corporation; Planiseal VS.
- B. MVE-Control System: ASTM F3010-qualified, fluid-applied, two-component, epoxy-resin, membrane-forming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor coverings indicated and acceptable to manufacturers of floor covering products indicated, including adhesives.
1. Substrate Primer: Provide MVE-control system manufacturer's concrete-substrate primer if required for system indicated by substrate conditions.
 2. Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE-control system manufacturer's primer to ensure adhesion of products to MVE-control system.

2.4 ACCESSORIES

- A. Patching and Leveling Material: Moisture-, mildew-, and alkali-resistant product recommended in writing by MVE-control system manufacturer and with minimum of 3000-psi compressive strength after 28 days when tested according to ASTM C109/C109M.
- B. Crack-Filling Material: Resin-based material recommended in writing by MVE-control system manufacturer for sealing concrete substrate crack repair.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Installation of system indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Preinstallation Testing:
1. Testing Agency: Engage a qualified testing agency to perform tests.
 2. Alkalinity Testing: Perform pH testing according to ASTM F710. Install MVE-control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 8.5.
 3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

- a. Internal Relative Humidity Test: Using in situ probes, ASTM F2170. Install MVE-control system in locations where concrete substrates exhibit relative humidity level greater than 75 percent.
- 4. Tensile-Bond-Strength Testing: for typical locations indicated to receive installation of MVE-control system, install minimum 100-sq. ft. area of MVE-control system to prepared concrete substrate and test according to ASTM D7234.
 - a. Proceed with installation only where tensile bond strength is greater than 200 psi with failure in the concrete.
- B. Concrete Substrates: Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.
 - 1. Remove coatings and other substances that are incompatible with MVE-control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE-control system manufacturer. Do not use solvents.
 - 2. Provide concrete surface profile complying with ICRI 310.2R CSP 3 by shot blasting using apparatus that abrades the concrete surface with shot, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - 3. After shot blasting, repair damaged and deteriorated concrete according to MVE-control system manufacturer's written instructions.
 - 4. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
 - 5. Fill surface depressions and irregularities with patching and leveling material.
 - 6. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack-filling material.
 - 7. Allow concrete to dry, undisturbed, for period recommended in writing by MVE-control system manufacturer after surface preparation, but not less than 24 hours.
 - 8. Before installing MVE-control systems, broom sweep and vacuum prepared concrete.
- C. Protect walls, floor openings, electrical openings, door frames, and other obstructions during installation.

3.3 INSTALLATION

- A. Install MVE-control system according to ASTM F3010 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.
 - 1. Install primers as required to comply with manufacturer's written instructions.
- B. Do not apply MVE-control system across substrate expansion, isolation, and other moving joints.
- C. Apply system, including component coats if any, in thickness recommended in writing by MVE-control system manufacturer for MVER indicated by preinstallation testing.
- D. Cure MVE-control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.
- E. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform installation inspections.
- B. Installation Inspections: Inspect substrate preparation and installation of system components to ensure compliance with manufacturer's written instructions and to ensure that a complete MVE-control system is installed without deficiencies.
 - 1. Verify that surface preparation meets requirements.
 - 2. Verify that component coats and complete MVE-control-system film thicknesses comply with manufacturer's written instructions.
 - 3. Verify that MVE-control-system components and installation areas that evidence deficiencies are repaired according to manufacturer's written instructions.
- C. MVE-control system will be considered defective if it does not pass inspections.

3.5 PROTECTION

- A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.
- B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise the MVE-control system membrane.

END OF SECTION

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SECTION 092116 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Gypsum board shaft wall assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements in accordance with Section 018113.

1.3 DELIVERY, STORAGE, AND HANDLING

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

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with gypsum-shaftliner-board manufacturer's written instructions.
- B. Do not install finish panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E90 and classified according to ASTM E413 by a testing and inspecting agency.

2.2 SUSTAINABLE DESIGN REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection as indicated in Section 018113, including the following:

1. Low-Emitting Materials: Adhesives and Sealants.
2. Low-Emitting Materials: Insulation.

2.3 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: As indicated on Drawings.
- B. STC Rating: As indicated on Drawings.
- C. Gypsum Shaftliner Board:
 1. Moisture- and Mold-Resistant Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with ASTM D3273 mold-resistance score of 10 as rated according to ASTM D3274, 1 inch thick, and with double beveled long edges.
- D. Non-Load-Bearing Steel Framing, General: Complying with ASTM C645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.
 1. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653/A653M, G40 unless otherwise indicated.
- E. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:
 1. Depth: As indicated.
 2. Minimum Base-Metal Thickness: 0.030 inch.
- F. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
 1. Minimum Base-Metal Thickness: Matching steel studs.
- G. Firestop Tracks: 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.
- H. Finish Panels: Gypsum board as specified in Section 092900 "Gypsum Board," or Cementitious backer units as specified in Section 092900 "Gypsum Board" where applicable.
- I. Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."

2.4 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with shaft wall manufacturer's written instructions.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.
 - 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
- E. Reinforcing: Galvanized-steel reinforcing strips with 0.033-inch minimum thickness of base metal (uncoated).
- F. Acoustical Sealant: Section 079219 "Acoustical Joint Sealants."
- G. Gypsum Board Cants:
 - 1. Gypsum Board Panels: As specified in Section 092900 "Gypsum Board," Type X, 1/2- or 5/8-inch panels.
 - 2. Adhesive: Laminating adhesive as specified in Section 092900 "Gypsum Board."
 - 3. Non-Load-Bearing Steel Framing: As specified in Section 092216 "Non-Structural Metal Framing."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.
- B. Do not bridge building expansion joints with shaft wall assemblies, frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
 - 1. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.

- D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.
- E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.
- F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- G. Control Joints: Install control joints at locations indicated on Drawings, or if not indicated, locate according to ASTM C840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
- H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.
- I. Gypsum Board Cants: At projections into shaft exceeding 4 inches, install gypsum board cants covering tops of projections.
 - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
 - 2. Where non-load-bearing steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft wall framing.
- J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet, or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.
2. Section 072100 "Thermal Insulation" for fiberglass batts in concealed spaces in floor/ceiling assemblies.

1.2 ACTION SUBMITTALS

- ##### A. Product Data:
- For each type of product. Include applicable limiting heights tables.

1.3 INFORMATIONAL SUBMITTALS

- ##### A. Evaluation Reports:
- For embossed, high-strength steel studs and tracks, firestop tracks, post-installed anchors, and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- ##### A. Fire-Test-Response Characteristics:
- For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
- ##### B. STC-Rated Assemblies:
- For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- ##### C. Horizontal Deflection, composite wall assemblies:
- Unless otherwise noted, limited to 1/240 of the wall height based on horizontal loading of specified finishes.
1. For wall assemblies scheduled to receive tile limit deflection to L/360 of the wall height.
 2. For wall assemblies scheduled to receive plaster, limit deflection to L/360.
- ##### D. Horizontal Deflection, non-composite wall assemblies:
- Unless otherwise noted, limited to 1/240 of the wall height based on horizontal loading of specified finishes.
1. For wall assemblies scheduled to receive tile limit deflection to 1/360 of the wall height.
 2. For wall assemblies scheduled to receive plaster, limit deflection to L/360.

- E. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.
- F. Design Loads: Actual weight of material, but not less than the following:
 - 1. Gypsum Wallboard, both sides: 7.5 lbs./sq. ft.
 - 2. Gypsum Wallboard, single side: 5 lbs./sq. ft.
- G. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of one inch.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
 - 2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.
 - 1. Conventional Steel Studs and Tracks:
 - a. Minimum Base-Steel Thickness: Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection but not less than 0.0269 inch.
 - b. Minimum Base-Steel Thickness: At framing to receive cementitious tile backer units: 0.0329 inch.
 - c. Depth: As indicated on Drawings.
 - 2. Embossed Steel Studs and Tracks:
 - a. Minimum Base-Steel Thickness: Equivalent to conventional studs, as validated by third party testing, and meeting the horizontal deflection performance requirements.
 - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Single Long-Leg Track System: ASTM C645 top track with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 - 2. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of 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.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Steel Thickness: 0.0329 inch.

- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.
 - 1. Depth: 1-1/2 inches.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C645.
 - 1. Minimum Base-Steel Thickness: 0.0296 inch.
 - 2. Depth: As indicated on Drawings.
- H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical.
 - 2. Product: Clark Dietrich, RC Deluxe Resilient Channel. NO SUBSTITUTIONS.
- I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
 - 1. Depth: 3/4 inch.
 - 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
 - 3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch not less than HW 12/0.1055 inch in diameter and meeting CISC standard for the applicable seismic zone and the suspension system manufacturer's written recommendations.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.
 - 1. Depth: 2 inches, unless otherwise indicated on Drawings.
- E. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
 - 2. Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Steel Thickness: 0.0179 inch.
 - b. Depth: As indicated on Drawings.

3. Embossed, High-Strength Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Steel Thickness: 0.0147 inch.
 - b. Depth: As indicated on Drawings.
4. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.
 - a. Minimum Base-Steel Thickness: 0.0296 inch.
5. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical.
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock; fire-rated where indicated on Drawings.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following:
 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8-inch-thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
2. Install metal fasteners to not interfere with gypsum board installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 2. Multilayer Application: 24 inches o.c. unless otherwise indicated.
 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: 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.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 24 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. 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 locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

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SECTION 092400 - CEMENT PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior cement plaster (stucco) engineered performance mix for applications indicated.
2. Accessories.

1.2 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Metal lath.
2. Base-coat cement plaster.
3. Cement plaster finish coats.
4. Accessories.

- ##### B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

- ##### C. Samples: For each type of factory-prepared finish coat and for each color and texture specified, 12 by 12 inches, and prepared on rigid backing.

1.4 QUALITY ASSURANCE

- ##### A. Plaster Applicator Qualifications: A qualified trade specialist, experienced in plaster applications of the type and extent required for this Project. Firm shall have completed a minimum of five recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.

- ##### B. Mockups: Install a sample panel where directed by the Architect to serve as the quality standard for materials and execution.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Approved sample panel may remain as part of the work.

1.5 DELIVERY, STORAGE AND HANDLING

- ##### A. Store materials inside under cover and keep them dry and protected against damage from weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.6 FIELD CONDITIONS

- ##### A. Comply with ASTM C926 requirements.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F.
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. Obtain plaster materials from single source from single manufacturer.
- B. Fire-Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance in accordance with ASTM E119 by a qualified testing agency.
- C. System Nominal Thickness: 7/8-inch.
- D. Colors: Two colors where indicated on the Drawings. Match the Architect's samples.

2.2 METAL LATH

- A. Expanded-Metal Lath: ASTM C847, cold-rolled carbon-steel sheet with ASTM A653/A653M, G60, hot-dip galvanized-zinc coating.
 1. Diamond-Mesh Lath: Self-furring, 2.5 lb/sq. yd.
- B. Paper Backing: FS UU-B-790a, Type I, Grade D, Style 2 vapor-permeable paper.
 1. Provide paper-backed lath at exterior locations.

2.3 BASE-COAT CEMENT PLASTER

- A. General: Comply with ASTM C926 for applications indicated.
- B. Base-Coat Mixes for Use over Metal Lath: Portland Cement mixes. Scratch and brown coats for three-coat plasterwork over sheathing.

2.4 CEMENT PLASTER FINISH COATS

- A. Provide one of the following at Contractor's option.
- B. Job-Mixed Finish-Coat Mixes:
 1. Portland Cement Mix: For cementitious materials, mix 1-part portland cement and 1-1/2 to 2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
 2. Portland and Masonry Cement Mix: For cementitious materials, mix 1-part portland cement and 1 part masonry cement. Use 1-1/2 to 3 parts aggregate per part of cementitious material.

- C. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, coloring agents, and proprietary ingredients.

2.5 ACCESSORIES

- A. General: Comply with ASTM C1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- B. Metal Accessories:
 - 1. Cornerite: Fabricated from metal lath with ASTM A653/A653M, G60, hot-dip galvanized-zinc coating.
 - 2. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A653/A653M, G60, hot-dip galvanized-zinc coating.
- C. Plastic Accessories: Manufactured from high-impact PVC.
 - 1. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
 - a. Square-edge style; use unless otherwise indicated.
 - b. Bullnose style, radius 3/4-inch minimum; use at locations indicated on Drawings.
 - 2. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
 - 3. Expansion Joints: Two-piece type, formed to produce slip-joint and square-edged 1/2-inch-wide reveal; with perforated concealed flanges.
 - 4. Foundation Weep Screeds: With perforated sloped flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.

2.6 PLASTER MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I.
- B. Lime: ASTM C206, Type S; or ASTM C207, Type S.
- C. Sand Aggregate: ASTM C897.
- D. Engineered Performance Mix: Factory mixed and packaged mix requiring only the addition of water at the job site.
 - 1. Available manufacturers offering products that may be incorporated into the Project are listed on the website of the Stucco Manufacturers Association: <https://stuccomfgassoc.com/the-sma/member-directory/>
 - a. Amerix, an OldCastle APG Brand.
 - b. Omega Products.
 - c. Parex.
 - d. Master Wall, Inc.

2.7 MISCELLANEOUS MATERIALS

- A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

- B. Fasteners for Attaching Metal Lath to Substrates: ASTM C1063.
- C. Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare smooth, solid substrates for plaster in accordance with ASTM C926.

3.3 INSTALLATION, GENERAL

- A. Fire-Resistance-Rated Assemblies: Install components according to requirements for design designations from listing organization and publication indicated on Drawings.

3.4 INSTALLATION OF METAL LATH

- A. Metal Lath: Install in accordance with ASTM C1063.
 - 1. Partition Framing and Vertical Furring: Install flat-diamond-mesh lath.

3.5 INSTALLATION OF ACCESSORIES

- A. Install in accordance with ASTM C1063 and at locations indicated on Drawings.
- B. Reinforcement for External (Outside) Corners:
 - 1. Install lath-type, external-corner reinforcement at exterior locations.
- C. Control Joints: Locate as approved by Architect for visual effect and as follows:
 - 1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
 - a. Vertical Surfaces: 144 sq. ft.
 - b. Horizontal and Other Nonvertical Surfaces: 100 sq. ft.
 - 2. At distances between control joints of not greater than 18 feet o.c.
 - 3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
 - 4. Where control joints occur in surface of construction directly behind plaster.
 - 5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.6 APPLICATION OF BASE-COAT CEMENT PLASTER

- A. General: Comply with ASTM C926.
 - 1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces when measured by a 10-foot straightedge placed on surface.
 - 2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
 - 3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
- B. Walls; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork with 3/4-inch total thickness, as follows:
 - 1. Portland cement mixes.
 - 2. Engineered mix.

3.7 APPLICATION OF CEMENT PLASTER FINISH COATS

- A. Plaster Finish Coats: Apply to provide finish to match Architect's sample.

3.8 REPAIR

- A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.9 CLEANING

- A. Remove temporary protection and enclosure of other work after plastering is complete.
- B. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered.
- C. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION

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SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Interior gypsum board.
2. Tile backing panels.
3. Sound attenuation blankets.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

1.3 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
1. Low-Emitting Materials: Adhesives and Sealants.
 2. Low-Emitting Materials: Walls.
 3. Low-Emitting Materials: Ceilings.

2.2 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
- B. Gypsum Wallboard: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- C. Type X:
1. Thickness: 5/8 inch.

2. Long Edges: Tapered.

- D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X, as required for application.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10.
4. Location: Exterior walls, and wet locations as follow:

- a. Bathrooms.
- b. Kitchens.
- c. Laundry rooms.

- E. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.

1. Core: 5/8-inch, Type X.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
5. Long Edges: Tapered.

2.3 SPECIALTY GYPSUM BOARD

- A. Glass-Mat Interior Gypsum Board ("Paperless"): ASTM C1658/C1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Georgia-Pacific Gypsum LLC.
 - b. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - c. PABCO Gypsum.
 - d. USG Corporation.
2. Core: 5/8 inch (15.9 mm), Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
5. Application: Where indicated, and where required to comply with [FEMA Technical Bulletin #2](#).

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
 - a. CertainTeed Corporation; FiberCement BackerBoard.
 - b. National Gypsum Company; PermaBase® Cement Board.
 - c. USG Corporation; USG Durock® Brand Cement Board.
2. Thickness: 5/8inch.

3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
- B. Fire-Rated Wall Reveal: Stockton Products DRM-RR Rated Reveal for applications indicated and as follows:
 1. Certified Compliance: ASTM E119.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 1. Interior Gypsum Wallboard: Paper.
 2. Paperless Gypsum Board and 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, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Resilient Furring Channels: Steel sheet members designed to reduce sound transmission.
 1. Product: ClarkDietrich, RC Deluxe (RCSD).

2. Configuration: Single leg.
- D. 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.
- E. Mineral-Wool Blanket Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
 1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
 4. Application: Provide where indicated on the Drawings.
- F. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- D. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

3.2 APPLYING FRAMING ACCESSORIES

- A. Install resilient furring channels over wood framing in locations indicated.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 1. Regular Type: All surfaces, unless otherwise indicated.
 2. Moisture- and Mold-Resistant Type: Exterior walls and wet locations, and locations installed prior to building enclosure.
 3. Abuse-Resistant Type/Moisture- and Mold-Resistant Type: Unconditioned spaces, public spaces, and where indicated.
 4. Glass-Mat Interior Gypsum Board: Where required to comply with [FEMA Technical Bulletin #2](#)

3.4 INSTALLING TRIM ACCESSORIES

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

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
 - 1. Level 1: Ceiling plenum areas, concealed areas, exterior storage closets, and where indicated.
 - 2. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in other Division 09 Sections.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.6 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic mosaic tile.
2. Porcelain tile.
3. Glazed wall tile.
4. Stone thresholds.
5. Crack isolation membrane.
6. Waterproof membrane for thinset applications.
7. Metal edge strips.

B. Related Sections Include:

1. Section 092900 "Gypsum Board" for tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Stone thresholds in 6-inch lengths.
4. Metal edge strips in 6-inch lengths.

1.3 DEFINITIONS

1.4 Large Format Tile: A tile with any side greater than 15 inches in length.

1.5 QUALITY ASSURANCE

A. Mockups: Initial installation shall serve as mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas or exterior areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.2 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Low-Emitting Materials: Flooring.

2.3 TILE PRODUCTS

- A. Ceramic Tile: Glazed wall tile.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. American Marazzi Tile, Inc.
 - b. American Olean; a division of Dal-Tile Corporation.
 - c. Daltile.
 - d. Seneca Tiles, Inc.
 - 2. Tile Color and Pattern: As indicated by manufacturer's designations, or if not indicated, as selected by Architect from manufacturer's full range.
 - 3. Grout Color: As indicated by manufacturer's designations, or if not indicated, as selected by Architect from manufacturer's full range.
- B. Ceramic Tile: Porcelain tile.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- a. American Marazzi Tile, Inc.
 - b. American Olean; a division of Dal-Tile Corporation.
 - c. Crossville, Inc.
 - d. Daltile.
 - e. Florida Tile, Inc.
 - f. Interceramic.
 - g. Seneca Tiles, Inc.
 2. Tile Color and Pattern: As indicated by manufacturer's designations, or if not indicated, as selected by Architect from manufacturer's full range.
 3. Grout Color: As indicated by manufacturer's designations, or if not indicated, as selected by Architect from manufacturer's full range.
 - C. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Indicate proposed trim units on Shop Drawings if trim units are not scheduled.
- 2.4 THRESHOLDS
- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
 - B. Metal Flooring Transitions: Profile designed specifically for flooring applications; height to match tile and setting-bed thickness.
- 2.5 WATERPROOFING AND CRACK ISOLATION MEMBRANE
- A. General: Manufacturer's standard product that complies with ANSI A118.10 and ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
 - B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ARDEX Americas; ARDEX 8+9™ Rapid Waterproofing and Crack Isolation Compound.
 - b. Bonsal American, an Oldcastle company; B 6000 Waterproof-Crack Isolation Membrane.
 - c. Custom Building Products; CBP-9240 Waterproofing & Anti-Fracture Membrane RedGard; SpeedCoat Waterproofing Membrane; RedGard Waterproofing and Crack Prevention Membrane.
 - d. H.B. Fuller Construction Products Inc. / TEC; Hydraflex Waterproofing Crack Isolation Membrane.
 - e. LATICRETE SUPERCAP, LLC; Laticrete Hydro Ban Waterproofing Crack Isolation Membrane; Laticrete Hydro Barrier Waterproofing Crack Isolation Membrane.
 - f. MAPEI Corporation; Mapelastic AquaDefense Waterproofing Crack Isolation Membrane.

2.6 SETTING MATERIALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ARDEX Americas.
 - 2. Bonsal American, an Oldcastle company.
 - 3. Custom Building Products.
 - 4. H.B. Fuller Construction Products Inc. / TEC.
 - 5. LATICRETE SUPERCAP, LLC.
 - 6. MAPEI Corporation.
- B. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
 - 1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- C. LHT (Medium-Bed) Modified Dry-Set Mortar: Where recommended by manufacture due to tile dimensions: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch.
 - 1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 2. At elevator cab, provide flexible mortar. Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products: VersaBond Flex.
 - b. Mapei; Ultraflex LFT.
 - c. Laticrete; 254 Platinum.
- D. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.
 - 1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.

2.7 GROUT MATERIALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ARDEX Americas.
 - 2. Bonsal American, an Oldcastle company.
 - 3. Custom Building Products.
 - 4. H.B. Fuller Construction Products Inc. / TEC.
 - 5. LATICRETE SUPERCAP, LLC.
 - 6. MAPEI Corporation.
- B. High-Performance Tile Grout: ANSI A118.7.

1. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

- C. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

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. Metal Edge Strips:

1. At Wall Outside Corners: Product: Schluter, QUADDEC/-K.
2. At Wall Top of Base or Wainscot: Product: Schluter, Schiene.
3. At Base of Wall: Schluter DESIGNBASE SL.

- C. Shower Kit: Waterproof enclosure for tile showers consisting of shower tray, shower curb, waterproofing membrane, and transition strips.

1. Product: Schluter, KERDI-SHOWER-KIT.

- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

- E. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

- F. Joint Sealant: Silicone, S, NS, 25, T, NT: Single-component, nonsag or pourable, plus 25 percent and minus 25 percent movement capability, Shore A hardness not less than 35, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade N or P, Class 25, Uses T and NT.

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 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of 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.

3.2 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Exterior tile floors and walls.
 - b. Tile floors in wet areas.
 - c. Tile swimming pool decks.
 - d. Tile floors in laundries.
 - e. Tile floors consisting of tiles 8 by 8 inches or larger.
 - f. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

- G. Joint Widths: Unless otherwise indicated, install tile with joints no narrower than three times the dimensional variance in the tile, or the narrowest joint recommended by the manufacturer of the tile. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on approved Shop Drawings. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Provide joints where field of tile interfaces with restraining surface, such as at perimeter walls and columns.
 - 2. Provide joints where changes occur in backing material, other than drain strainers
 - 3. Provide minimum joints spacing in accordance with the recommendations by TCNA:
 - a. Interior, in direct sunlight or moisture: 8 to 12 feet in each direction.
 - b. Interior, suspended: 8 to 12 feet in each direction.
- I. Metal Edge Strips: Install at locations indicated.
- J. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.3 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Extend waterproofing membrane to drain flanges and flashed up perimeter walls and in-field interruptions including columns, chases, and wing walls to form watertight installation.
- C. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.4 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.5 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and

plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. For tile types and locations, refer to Room Finish Schedule.
- B. Interior Floor Installations, Wood Subfloor and Gypsum Underlayment:
 - 1. Ceramic Floor Tile Installation: TCNA F180; on cementitious bond coat on waterproofing membrane and underlayment.
 - a. Bond Coat: ANSI A118.4, LHT mortar for large format tile.
 - b. Grout: Cementitious ANSI A118.6.
 - c. Application: Porcelain Tile: Dry and wet areas on wood-framed subfloor.
- C. Interior Floor Installations, Elevator Cab:
 - 1. Ceramic Floor Tile Installation: Sim TCNA F144; on thinset mortar on cementitious backer board on crack-isolation membrane.
 - a. Bond Coat: ANSI A118.4, flexible LHT mortar for large format tile.
 - b. Grout: Cementitious ANSI A118.6.
 - c. Application: Porcelain Tile: Elevator cab.
- D. Shower Receptor and Wall Installations:
 - 1. Ceramic Tile Installation: TCNA B421; thinset mortar on waterproof membrane over solid backing.
 - a. Ceramic Tile Type: Glazed wall tile.
 - b. Ceramic Tile Type: Unglazed Porcelain tile or Ceramic Mosaic tile at receptor floor.
 - c. Thinset Mortar: Latex-portland cement mortar.
 - d. Grout: Water-cleanable epoxy grout.

END OF SECTION

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Acoustical panels.
 - 2. Exposed suspension systems for ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
 - 1. Acoustical Panels: Set of 6-inch-square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of manufacturer's standard size samples of each type, finish, and color.
 - 3. Clips: Full-size hold-down, impact, and seismic clips, if required for Project.

1.3 CLOSEOUT SUBMITTALS

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

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site 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.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E1264.
 - 2. Smoke-Developed Index: 50 or less.
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL or from the listings of another qualified testing agency.
- C. Ceiling Attenuation Class (CAC): Not less than that of basis of design product.
- D. Noise Reduction Coefficient (NRC): Not less than that of basis of design product.
- E. Articulation Class (AC): Not less than that of basis of design product.
- F. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.3 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Insulation: Acoustic insulation above ceiling where applicable.
 - 2. Low-Emitting Materials: Ceilings: Acoustical panels.
 - 3. Responsible Sourcing: Recycled content: Acoustical panels; grid components.
 - 4. Responsible Sourcing: Recyclable Content: Acoustical panels; grid components.
 - 5. Responsible Sourcing: Regionally sourced: Acoustical panels; grid components.
 - 6. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.4 MANUFACTURERS

- A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated on Finish Legend or comparable products by one of the following:

1. Armstrong Ceiling & Wall Solutions.
 2. CertainTeed Corporation.
 3. Rockfon (Rockwool International).
 4. USG Corporation.
- C. Classification: Provide panels as follows:
1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with acoustically transparent membrane.
 2. Pattern: E (lightly textured).
- D. Color: White.
- E. Light Reflectance (LR): Not less than 0.88.
- F. Ceiling Attenuation Class (CAC): Not less than 35.
- G. Noise Reduction Coefficient (NRC): Not less than 0.80.
- H. Articulation Class (AC): Not less than 170.
- I. Edge/Joint Detail: Beveled tegular.
- J. Thickness: 7/8 inch.
- K. Modular Size: As indicated on Drawings.
- L. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.5 METAL SUSPENSION SYSTEM

- A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.
1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C635/C635M.
 2. Where indicated provide fire-rated suspension system.
- 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, G30 coating designation; with prefinished 9/16-inch-wide metal caps on flanges.
1. Basis of Design: Armstrong Suprafine.
 2. Structural Classification: Intermediate-duty system.
 3. End Condition of Cross Runners: Butt-edge type.
 4. Face Design: Flat, flush.
 5. Cap Material: Aluminum.
 6. Cap Finish: Painted white.

2.6 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Postinstalled expansion or postinstalled bonded anchors.
 - b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B633, Class SC 1 (mild) service condition.
 - c. Corrosion Protection: At high humidity locations: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
 2. 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 according to ASTM E1190, conducted by a qualified testing and inspecting agency.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 2. Stainless-Steel Wire: At high humidity locations: ASTM A 580/A 580M, Type 304, nonmagnetic.
 3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.135-inch-diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8-inch-wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

2.7 ACOUSTICAL SEALANT AND INSULATION

- A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."
- B. Acoustic Insulation:
 1. 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.
 - a. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

2.8 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 - 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
 - 1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

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. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. 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 unless otherwise indicated and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.
- 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.
 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure 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. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 6. 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.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. 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 o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. 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 precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.

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. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
5. 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.

- G. Install acoustic insulation on ceiling panels as work progresses. Cover entire areas indicated.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners' level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 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.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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SECTION 095423 - LINEAR METAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Linear metal ceilings.

1.2 COORDINATION

- A. Coordinate layout and installation of linear metal pans 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.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For linear metal ceilings.

- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements in accordance with Section 018113.

- C. Shop Drawings: For linear metal ceilings.

1. Include reflected ceiling plans, sections, and details, drawn to scale, showing the following:

- a. Linear ceiling patterns and joints.
- b. Ceiling suspension members.
- c. Method of attaching hangers to building structure and locations of cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
- d. Ceiling-mounted items including, but not limited to, light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
- e. Ceiling perimeter and penetrations through ceiling; trim and moldings.

- D. Samples: For each exposed product and for each type, color, and finish specified, 12 inches long in size.

- E. Samples for Initial Selection: For units with factory-applied colors and finishes.

1. Include Samples of accessories involving color and finish selections.

- F. Samples for Verification: For the following products:

1. Linear Metal Pans: 12 inches long by full-width Samples of each type, color, and finish and a 12-inch-long spliced section.
2. Suspension-System Members: 12-inch-long Sample of each type.
3. Exposed Molding and Trim: 12-inch-long Samples of each type, color, and finish.
4. End Caps: Full size.

1.5 CLOSEOUT SUBMITTALS

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

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Linear-Metal-Ceiling Components: Quantity of each pan, carrier, accessory, and exposed molding and trim equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

- A. Mockups: Build in-place mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockup of each type of linear metal ceiling as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ceiling components and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Handle ceiling components and accessories in a manner that prevents damage.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install interior ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings 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.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Insulation: Acoustic insulation above ceiling where applicable.
 - 2. Low-Emitting Materials: Ceilings: Acoustical panels.
 - 3. Responsible Sourcing: Recycled content: Acoustical panels; grid components.
 - 4. Responsible Sourcing: Recyclable Content: Acoustical panels; grid components.
 - 5. Responsible Sourcing: Regionally sourced: Acoustical panels; grid components.
 - 6. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Exterior linear metal ceilings to withstand exterior exposure, the effects of gravity loads, and the following loads and stresses without showing permanent deformation of ceiling system components, including pans and suspension system; noise or metal fatigue caused by vibration, deflection, and displacement of ceiling pans; or permanent damage to fasteners and anchors:
 - 1. Wind Load: Uniform pressure indicated on Drawings, acting inward or outward.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

2.3 LINEAR METAL CEILINGS

- A. Pans and Suspension System:
 - 1. Basis of Design: Subject to requirements provide [Armstrong METALWORKS Linear Synchro Ceiling Planks](#) 6 inch width, or one of the following:
 - a. Rulon International, Endure Linear Ceiling Panels 900 Profile with integrated spacers.
 - b. USG Planx Linear Metal Pans, 6-inch width.
- B. Metal Pans: Complying with ASTM E1264 for Type XIII and formed to snap on to carriers securely, without separate fasteners.
 - 1. Surface-Burning Characteristics: For metal-pan assemblies, including backings, determined by testing in accordance with ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
 - 2. Metal: Steel, electrogalvanized, or aluminum as standard with manufacturer.
 - 3. Form: Nonperforated.
 - 4. Pan Thickness: Not less than 0.028 inch.
 - 5. Pan Edge Detail: Square.
 - 6. Pan Width: 6-inch module width.
 - 7. Pan Depth: 1 inch.
 - 8. Metal-Pan Finish: Protected on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping and as follows:
 - a. Laminated-Film Finish: Provide manufacturer's standard film permanently bonded to metal pan with adhesive.
 - 1) Color and Pattern: As selected by Architect from manufacturer's full range of wood grain finishes.
 - b. Finish Bonding Adhesive: Manufacturer's standard that permanently bonds finish to aluminum.

- C. Pan Splices: Formed for snap fit into butt-cut pans, 4 inches long.
 - 1. Finish: Manufacturer's standard.
- D. End Caps: Manufacturer's standard material fabricated to fit and conceal exposed ends of pans.
 - 1. Finish: Manufacturer's standard.
- E. Filler Strips: Not required.
- F. Moldings and Trim: Manufacturer's standard for exposed members, to conceal edges of penetrations through ceiling, to conceal ends of pans and carriers, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching linear metal pans or extruded plastic unless otherwise indicated.
- G. Carrier Suspension System: Manufacturer's standard complying with requirements in ASTM C635/C635M for applications indicated; complete with carriers, splice sections, stabilizing components, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, fixture adapters, and other suspension components required to support ceiling units and other ceiling-supported construction.
 - 1. Material: ASTM B209 aluminum.
 - 2. Structural Classification: Heavy-duty system.
 - 3. Expansion Carriers: Manufacturer's standard carriers allowing for irregularities or other unusual space conditions.
 - 4. Stabilizer Channels, Tees, and Bars: Manufacturer's standard components for stabilizing main carriers.
 - 5. Carrier Splices: Same metal, profile, and finish as for carriers.
 - 6. Hold-Down Clips: Manufacturer's standard hold-down clips spaced as standard with manufacturer.
 - 7. Carrier Finish: Flat black.

2.4 CARRIER-SYSTEM HANGERS, BRACES, AND TIES

- A. Attachment Devices: Size for 5 times the design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated.
- B. Wire Hangers, Braces, and Ties: Provide wire complying with the following requirements:
 - 1. Stainless Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
 - 2. Size: Select wire diameter so its stress at 3 times the hanger design load indicated in ASTM C635/C635M, Table 1, Direct Hung is less than yield stress of wire, but provides not less than 0.106-inch-diameter wire.
- C. Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Exterior Bracing: Cold-rolled steel channels and angles, hot-dip galvanized to comply with ASTM A653/A653M, G60 coating designation; size and profile as required to withstand wind load.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which linear metal 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 linear metal ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of linear metal pans.
 - 1. Balance border widths at opposite edges of each ceiling.
 - 2. Avoid using less-than-half-width pans at borders.

3.3 INSTALLATION OF LINEAR METAL CEILINGS

- A. Comply with ASTM C636/C636M and seismic requirement indicated, in accordance with 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.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns in 3 inches. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate to which hangers are attached and for type of hanger involved.
 - 5. Do not support ceilings directly from permanent metal forms or floor deck.
 - 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 7. Do not attach hangers to steel deck tabs.
 - 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns in 1-1/2 inches. Suspend bracing from building's structural members as required for hangers and without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

- D. Install edge moldings and trim at perimeter of linear metal ceiling area and where necessary to conceal edges and ends of linear metal pans.
 - 1. Screw attach moldings to substrate at intervals of not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
- E. Install suspension-system carriers so they are aligned and securely interlocked with one another.
 - 1. Install stabilizer channels, tees, and bars at regular intervals to stabilize carriers and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated.
 - 2. Remove and replace dented, bent, or kinked members.
- F. Cut linear metal pans for accurate fit at borders and at interruptions and penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness.
- G. Install linear metal pans in coordination with suspension system and exposed moldings and trim.
 - 1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions unless otherwise indicated on Drawings.
 - 2. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
 - a. Install pans with butt joints staggered a minimum of 12 inches using internal pan splices.
 - 3. Install directionally textured or patterned metal pans in directions indicated.
 - 4. Where metal pan ends are visible, install end caps unless trim is indicated.
- H. Install hold-down clips.

3.4 CLEANING

- A. Clean exposed surfaces of linear metal ceilings, including trim and edge moldings, after removing strippable, temporary protective covering if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, 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, including dented and bent units.

END OF SECTION

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermoset-rubber base.
 - 2. Rubber stair accessories.
 - 3. Rubber molding accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
- D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, 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 for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 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 or more than 90 deg F.

1.5 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Low-Emitting Materials: Flooring.
 - 3. Certified Flooring Products - SCS Floorscore.

2.2 THERMOSET-RUBBER BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following comparable to scheduled product if any, including scheduled color selections:
 - 1. Burke Mercer Flooring Products; a division of Burke Industries Inc.
 - 2. Flexco.
 - 3. Johnsonite; a Tarkett company.
 - 4. Roppe Corporation, USA.
- B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. Style A, Straight: Provide in areas with carpet.
 - b. Style B, Cove: Provide in areas with resilient floor coverings or no floor covering.
- C. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic), Group: I (solid, homogeneous).
- D. Thickness: 0.125 inch.
- E. Height: 4 inches unless otherwise indicated on Drawings.
- F. Lengths: Coils in manufacturer's standard length.
- G. Outside Corners: Job formed.
- H. Inside Corners: Job formed.
- I. Colors: As indicated by manufacturer's designations.

2.3 RUBBER STAIR ACCESSORIES

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following if providing acceptable match to scheduled products:

1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products; a division of Burke Industries Inc.
3. Flexco.
4. Johnsonite; a Tarkett company.

C. Stair Treads: ASTM F2169.

1. Type: TS (rubber, vulcanized thermoset).
2. Class: 2 (pattern; embossed, grooved, or ribbed).
3. Group: 1 (embedded abrasive strips) 2 (with contrasting color for the visually impaired).
4. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
5. Nosing Height: 1-1/2 inches.
6. Thickness: 1/4 inch and tapered to back edge.
7. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.

D. Separate Risers: Smooth, flat; in height that fully covers substrate; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

1. Style: Coved toe, 7 inches high by length matching treads.
2. Thickness: Manufacturer's standard.

E. Landing Tile: Matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

F. Locations: Provide rubber stair accessories in areas indicated.

G. Colors and Patterns: As indicated by manufacturer's designations.

2.4 RUBBER MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following if providing acceptable match to scheduled products:

1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products; a division of Burke Industries Inc.
3. Flexco.
4. Johnsonite; a Tarkett company.

B. Description: Rubber carpet edge for glue-down applications; nosing for carpet; nosing for resilient floor covering; reducer strip for resilient floor covering; joiner for tile and carpet; transition strips.

C. Profile and Dimensions: As approved by Architect.

D. Locations: Provide rubber molding accessories in areas described above subject to approval by Architect.

E. Colors and Patterns: As indicated by manufacturer's designations.

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 meeting sustainable design requirements, recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
- C. Adhesive, Rubber Stair Treads and Risers: Two-part epoxy adhesive formulated for use in applying rubber stair treads to concrete-filled metal pan stairs.
- D. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

EXECUTION

2.6 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 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.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

2.7 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. 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.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

2.8 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Form without producing discoloration (whitening) at bends.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
 - a. Miter or cope corners to minimize open joints.

2.9 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
 - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 - 2. Tightly adhere to substrates throughout length of each piece.
 - 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

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

2.10 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum horizontal surfaces thoroughly.
 - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid vinyl floor tile (LVT).
 - 2. Rubber floor tile.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Shop Drawings: For each type of resilient floor tile.
 - 1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 2. Show details of special patterns.
- D. Samples for Verification: Full-size units of each color and pattern of floor tile required.
- E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.
- B. Mockups: Build in-place mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.

- a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile 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 or more than 90 deg F. Store floor tiles on flat surfaces.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:
 1. 48 hours before installation.
 2. During installation.
 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
 1. Low-Emitting Materials: Adhesives and Sealants.
 2. Low-Emitting Materials: Flooring.
 3. Certified Flooring Products - SCS Floorscore.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.3 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following comparable to scheduled product if any, including scheduled color selections:
 - 1. Armstrong Flooring, Inc.
 - 2. Mannington Commercial.
 - 3. Patcraft; a division of Shaw Industries, Inc.
 - 4. Shaw Contract Group.
 - 5. Tarkett North America.

2.4 SOLID VINYL FLOOR TILE (LVT)

- A. Tile Standard: ASTM F1700.
 - 1. Class: Class III, Printed Film Vinyl Tile.
 - 2. Type: B, Embossed Surface.
- B. Thickness: 0.125 inch.
- C. Size: As indicated on Drawings.
- D. Colors and Patterns: As scheduled on Drawings.

2.5 RUBBER FLOOR TILE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following comparable to scheduled product if any, including scheduled color selections:
 - 1. Flexco.
 - 2. Mannington Commercial.
 - 3. Mannington Mills, Inc.
 - 4. Nora Systems, Inc.
 - 5. Tarkett North America.
- B. Tile Standard: ASTM F1344, Class I-A, Homogeneous Rubber Tile, solid color.
- C. Hardness: Match basis of design product.
- D. Wearing Surface: Molded pattern.
 - 1. Molded-Pattern Figure: As scheduled, or if not scheduled, as selected by Architect.
- E. Thickness: 0.125 inch.
- F. Size: As indicated on Drawings.
- G. Colors and Patterns: As scheduled on Drawings.

2.6 INSTALLATION MATERIALS

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

- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
- C. Adhesives, High Moisture: Water-resistant high-moisture type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions.
 - 1. Use adhesives approved by tile flooring manufacturer for installation on floor slabs with up to 7 lb. of vapor pressure, relative humidity of up to 90 percent, and pH up to 10.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 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 floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale acceptable to flooring and adhesive manufacturers.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum relative humidity level measurement acceptable to flooring and adhesive manufacturers.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor 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.
- C. Match floor 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.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. 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 marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to 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 CLEANING

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.

3.5 PROTECTION OF TILE

- A. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
 - 1. Cover floor tile until Substantial Completion.

END OF SECTION

SECTION 096566 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rubber sheet flooring.

1.2 SUBMITTALS

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

B. Shop Drawings: Show installation details and locations of the following:

1. Border tiles.
2. Floor patterns.
3. Seam locations for sheet flooring.

C. Samples: For each type of flooring indicated.

D. Maintenance data.

1.3 FIELD CONDITIONS

A. Adhesively Applied Products:

1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
2. After post installation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
3. Close spaces to traffic during flooring installation.
4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.

B. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RUBBER SHEET FLOORING

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Mondo America Inc.
2. Musson Rubber Co.
3. nora systems, Inc.
4. Robbins Sports Surfaces.
5. Roppe Corporation.
6. Sport Court; Subsidiary of Connor Sport Court International.

- B. Description: Rubber athletic flooring provided as rolled goods for adhered installation.
- C. Material: Rubber wear layer and rubber shock-absorbent layer, vulcanized together.
- D. Traffic-Surface Texture: Nondirectional, stipple texture.
- E. Roll Size: Not less than 48 inches wide by longest length that is practical to minimize splicing during installation.
- F. Thickness: 1/4 inch.
- G. Color and Pattern: As selected by Architect from manufacturer's full range.
- H. Border: Interlocking, beveled-edge tiles, of same material as floor tile.
 - 1. Border Color and Pattern: Matching floor tile.

2.2 ACCESSORIES

- A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.
- B. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.
 - 1. Adhesives shall have a VOC content of 60 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of flooring.
- 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 Testing: Perform pH testing according to ASTM F 710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.
 - 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. in 24 hours.
 - 1) Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.

- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- E. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
 - 1. Do not install flooring until they are same temperature as space where they are to be installed.
- F. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FLOORING INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions.
- B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

3.3 SHEET FLOORING INSTALLATION

- A. Unroll sheet flooring and allow it to stabilize before cutting and fitting.
- B. Lay out sheet flooring as follows:
 - 1. Maintain uniformity of flooring direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
 - 3. Match edges of flooring for color shading at seams.
 - 4. Locate seams per approved Shop Drawings.
- C. Adhered Flooring: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions.

3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after completing flooring installation:
 - 1. Remove adhesive and other blemishes from flooring surfaces.
 - 2. Sweep and vacuum flooring thoroughly.
 - 3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.
- B. Protect flooring 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

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modular carpet tile.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

C. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

D. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.

2. Failures include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
 1. Low-Emitting Materials: Adhesives and Sealants.
 2. Low-Emitting Materials: Flooring.
 3. Carpet - CRI Green Label.
 4. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.2 CARPET TILE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product including color and pattern by one of the following:
 1. Bentley Prince Street, Inc.
 2. Mohawk Group (The); Mohawk Carpet, LLC.
 3. Patcraft; a division of Shaw Industries, Inc.
 4. Shaw Contract Group; a Berkshire Hathaway company.
 5. Tandus; a Tarkett company.
- B. Backing/Backcoating: Manufacturer's standard composite materials comparable to Basis of Design product.
 1. Provide PVC-free backing/backcoating.
- C. Size: As scheduled.
- D. Applied Treatments:
 1. Soil-Resistance Treatment: Manufacturer's standard treatment meeting Performance Requirements.
 2. Antimicrobial Treatment: Not allowed.
- E. Performance Characteristics: Comparable to Basis of Design product

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum relative humidity level measurement complying with requirements of carpet and adhesive manufacturers.
 - b. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8-inch-wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns indicated on Drawings, or if not indicated, as recommended in writing by carpet tile manufacturer. Install pattern in accordance with approved shop drawings
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

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SECTION 098433 - SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:
 - 1. Sound-absorbing fabric-covered wall panels and ceiling applied units.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. **Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.**
- C. Shop Drawings: For unit assembly and installation.
 - 1. Include plans, elevations, sections, and mounting devices and details.
 - 2. Include details at panel head, base, joints, and corners, and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
 - 3. Include details at cutouts and penetrations for other work.
 - 4. Include direction of fabric weave and pattern matching.
- D. Samples for Initial Selection: For each type of fabric facing.
 - 1. Include Samples of hardware and accessories involving color or finish selection.
- E. Samples for Verification: For the following products:
 - 1. Fabric: Full-width by approximately 36-inch-long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
 - 2. Panel Edge: 12-inch-long Sample(s) showing each edge profile, corner, and finish.
 - 3. Core Material: 12-inch square Sample at corner.
 - 4. Mounting Devices: Full-size Samples.
 - 5. Assembled Panels: Approximately 36 by 36 inches, including joints and mounting methods.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Electrical outlets, switches, and thermostats.
 - 2. Items penetrating or covered by units including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.

- c. Speakers.
- d. Alarms.
- e. Sprinklers.
- f. Access panels.

3. Show operation of hinged and sliding components covered by or adjacent to units.

B. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 sq. yd., full width of bolt.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install units until a lighting level of not less than 50 fc is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication and indicate them on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to the following:

- a. Acoustical performance.

- b. Fabric sagging, distorting, or releasing from panel edge.
- c. Warping of core.

- 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall units specified in this Section from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.3 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Low-Emitting Materials: Insulation.
 - 3. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.4 SOUND-ABSORBING STRETCHED FABRIC WALL PANELS

- A. Sound-Absorbing Stretched Fabric Wall Panel AWP#1: Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Armstrong World Industries, Inc.
 - b. AVL Systems, Inc.
 - c. Conwed Designscape.
 - d. Decoustics Limited.
 - e. MBI Products Company, Inc.
 - 2. Mounting: Back mounted with metal clips or bar hangers, secured to substrate.

3. Core: Glass-fiber board. Provide wood or plywood nailing strips adhered to back of core.
 - a. Standard Panels: Unless indicated as impact resistant.
4. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
5. Edge Profile: Square profile.
6. Corner Detail in Elevation: Square with continuous edge profile indicated.
7. Facing Material: Provide scheduled product.
8. Acoustical Performance: Sound absorption NRC of not less than 0.65 according to ASTM C423 for Type A mounting according to ASTM E795.
9. Nominal Overall Panel Thickness: 1 inch.
10. Panel Width: As indicated on Drawings.
11. Panel Height: As indicated on Drawings.

B. Core Materials:

1. Glass-Fiber Board: ASTM C612; of type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft., unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

C. Facing Material: As scheduled. Fabric from same dye lot; color and pattern as scheduled as selected by Architect from manufacturer's full range.

1. Applied Treatments: Stain resistance and flame retardant.

D. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:

1. Impaling Clips: Manufacturer's standard.
2. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of unit and the other part to substrate, designed to permit unit removal.

2.5 SOUND-ABSORBING WALL UNITS, WOOL FELT UNFACED

A. Sound-Absorbing Wool Design Felt ACP#2: Manufacturer's standard roll goods consisting of wool felt, formaldehyde free.

1. Basis-of-Design Product: As scheduled.
2. Mounting: Adhesive.
3. Edge Profile: Square profile.
4. Color: As scheduled.

2.6 FABRICATION

A. Sound-Absorbing Stretched Fabric Wall Panel: Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

1. Edge Hardening: For glass-fiber board cores, chemically harden core edges and areas of core where mounting devices are attached.
2. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.

3. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
 - a. Square Corners: Tailor corners.
 - b. Radius and Other Nonsquare Corners: Attach facing material so there are no seams or gathering of material.
 - c. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent units.
- B. Dimensional Tolerances of Finished Units: Plus, or minus 1/16 inch for the following:
 1. Thickness.
 2. Edge straightness.
 3. Overall length and width.
 4. Squareness from corner to corner.
 5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.
- C. Align fabric pattern and grain with adjacent units unless otherwise indicated on Drawings.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus, or minus 1/16 inch in 48 inches, noncumulative.
- B. Variation of Joint Width: Not more than 1/32-inch variation from hairline in 48 inches, noncumulative.

3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION

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SECTION 098433 - SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:
 - 1. Sound-absorbing fabric-covered wall panels and ceiling applied units.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. **Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.**
- C. Shop Drawings: For unit assembly and installation.
 - 1. Include plans, elevations, sections, and mounting devices and details.
 - 2. Include details at panel head, base, joints, and corners, and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
 - 3. Include details at cutouts and penetrations for other work.
 - 4. Include direction of fabric weave and pattern matching.
- D. Samples for Initial Selection: For each type of fabric facing.
 - 1. Include Samples of hardware and accessories involving color or finish selection.
- E. Samples for Verification: For the following products:
 - 1. Fabric: Full-width by approximately 36-inch-long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
 - 2. Panel Edge: 12-inch-long Sample(s) showing each edge profile, corner, and finish.
 - 3. Core Material: 12-inch square Sample at corner.
 - 4. Mounting Devices: Full-size Samples.
 - 5. Assembled Panels: Approximately 36 by 36 inches, including joints and mounting methods.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Electrical outlets, switches, and thermostats.
 - 2. Items penetrating or covered by units including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.

- c. Speakers.
- d. Alarms.
- e. Sprinklers.
- f. Access panels.

3. Show operation of hinged and sliding components covered by or adjacent to units.

B. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- 1. Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 sq. yd., full width of bolt.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install units until a lighting level of not less than 50 fc is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication and indicate them on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to the following:
 - a. Acoustical performance.

- b. Fabric sagging, distorting, or releasing from panel edge.
- c. Warping of core.

- 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall units specified in this Section from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.3 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Low-Emitting Materials: Insulation.
 - 3. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.4 SOUND-ABSORBING STRETCHED FABRIC WALL PANELS

- A. Sound-Absorbing Stretched Fabric Wall Panel AWP#1: Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Armstrong World Industries, Inc.
 - b. AVL Systems, Inc.
 - c. Conwed Designscape.
 - d. Decoustics Limited.
 - e. MBI Products Company, Inc.
 - 2. Mounting: Back mounted with metal clips or bar hangers, secured to substrate.

3. Core: Glass-fiber board. Provide wood or plywood nailing strips adhered to back of core.
 - a. Standard Panels: Unless indicated as impact resistant.
4. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
5. Edge Profile: Square profile.
6. Corner Detail in Elevation: Square with continuous edge profile indicated.
7. Facing Material: Provide scheduled product.
8. Acoustical Performance: Sound absorption NRC of not less than 0.65 according to ASTM C423 for Type A mounting according to ASTM E795.
9. Nominal Overall Panel Thickness: 1 inch.
10. Panel Width: As indicated on Drawings.
11. Panel Height: As indicated on Drawings.

B. Core Materials:

1. Glass-Fiber Board: ASTM C612; of type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft., unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

C. Facing Material: As scheduled. Fabric from same dye lot; color and pattern as scheduled as selected by Architect from manufacturer's full range.

1. Applied Treatments: Stain resistance and flame retardant.

D. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:

1. Impaling Clips: Manufacturer's standard.
2. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of unit and the other part to substrate, designed to permit unit removal.

2.5 SOUND-ABSOBING WALL UNITS, WOOL FELT UNFACED

A. Sound-Absorbing Wool Design Felt ACP#2: Manufacturer's standard roll goods consisting of wool felt, formaldehyde free.

1. Basis-of-Design Product: As scheduled.
2. Mounting: Adhesive.
3. Edge Profile: Square profile.
4. Color: As scheduled.

2.6 FABRICATION

A. Sound-Absorbing Stretched Fabric Wall Panel: Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

1. Edge Hardening: For glass-fiber board cores, chemically harden core edges and areas of core where mounting devices are attached.
2. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.

3. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
 - a. Square Corners: Tailor corners.
 - b. Radius and Other Nonsquare Corners: Attach facing material so there are no seams or gathering of material.
 - c. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent units.
- B. Dimensional Tolerances of Finished Units: Plus, or minus 1/16 inch for the following:
 1. Thickness.
 2. Edge straightness.
 3. Overall length and width.
 4. Squareness from corner to corner.
 5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.
- C. Align fabric pattern and grain with adjacent units unless otherwise indicated on Drawings.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus, or minus 1/16 inch in 48 inches, noncumulative.
- B. Variation of Joint Width: Not more than 1/32-inch variation from hairline in 48 inches, noncumulative.

3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION

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SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Finish coatings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of topcoat product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products of Sherwin-Williams Company (The) or comparable products by one of the following:
 1. Benjamin Moore & Co.
 2. PPG Paints.

2.2 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
 1. Provide materials for use within each paint system that are compatible with one another, and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.
- B. Colors: As indicated in a color schedule.

2.3 PRIMERS

- A. Exterior, Alkali-Resistant, Water-Based Primer: Pigmented, water-based primer formulated for use on alkaline surfaces, such as exterior plaster, vertical concrete, and masonry.
- B. Exterior, Latex Wood Primer: White, waterborne-emulsion primer formulated for resistance to extractive bleeding, mold, and microbials; for hiding stains; and for use on exterior wood subject to extractive bleeding.
- C. Exterior, Latex Block Filler: Water-based, pigmented, high-solids, emulsion coating formulated to bridge and fill porous surfaces of exterior concrete masonry units in preparation for specified subsequent coatings.
- D. Water-Based Bonding Primer: Pigmented, water-based-emulsion primer formulated for exterior use and to promote adhesion of subsequent specified coatings.

- E. Zinc-Rich, Inorganic Primer: Corrosion-resistant, inorganic-based, zinc-rich primer formulated for use on prepared steel subject to severe industrial or marine environments.
- F. Surface-Tolerant Metal Primer: Corrosion-resistant, solvent-based metal primer formulated for use on structural steel and metal fabrications that have been minimally prepared.

2.4 FINISH COATINGS

- A. Exterior Latex Paint, Low Sheen: Water-based, pigmented coating; formulated for alkali, mold, microbial, and water resistance and for use on exterior surfaces, such as portland cement plaster, concrete, and primed wood.
 - 1. Gloss and Sheen Level: Gloss of 10 to 35 units at 60 degrees and minimum sheen of 10 units at 85 degrees when tested in accordance with ASTM D523.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.
- B. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.

3.3 INSTALLATION

- A. Apply paints in accordance with manufacturer's written instructions.
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- B. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

- A. Steel and Galvanized Steel Substrates:
 - 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Primer, alkyd based, anti-corrosive for metal: S-W Kem Kromik Universal Metal Primer, B50AZ6 Series. Field re-prime factory-primed hollow metal doors and frames.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based, semi-gloss: S-W Pro Industrial Multi-Surface Acrylic Semi-Gloss Coating, B66-1550 Series.
 - d. Application: Interior and exterior surfaces of hollow metal doors and frames, and miscellaneous items requiring paint protection.
- B. Wood Substrates: Exterior wood trim.
 - 1. Latex System:
 - a. Prime Coat: Primer, alkyd for exterior wood: S-W Exterior Oil-Based Wood Primer YY24W08020.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Low-Sheen Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5): S-W SuperPaint Exterior Latex Satin A89-series.
- C. Fiber Cement Substrates: Panels and trim.
 - 1. Latex System:
 - a. Prime Coat: Factory applied.
 - b. Intermediate Coat: Latex, exterior, factory applied.
 - c. Low-Sheen Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4): S-W SuperPaint Exterior Latex Satin A89-series.

END OF SECTION

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SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Samples: For each type of paint system and in each color and gloss of topcoat.

1.3 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products of Sherwin-Williams Company (The) or comparable products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. PPG Paints.

2.2 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Low-Emitting Materials: Field applied interior paints and coatings.
 - 3. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.3 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As indicated in a color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Wood: 15 percent.
 2. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:

1. Water-Based Concrete Floor Sealer System: Clear, water-based, acrylic-copolymer-emulsion sealer formulated for oil, gasoline, alkali, and water resistance and for use on concrete traffic surfaces.
 - a. First Coat: Matching topcoat.
 - b. Topcoat: Water-based concrete floor sealer: S-W H&C ClariShield Water Based Natural Look Sealer.

B. Steel Substrates:

1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: S-W: Pro Industrial Pro-Cryl Universal Primer, B66W01310
 - b. Two Topcoats: S-W: Pro Industrial Pre-Catalyzed Semi-Gloss Epoxy, K46 Series

C. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: S-W: Pro Industrial Pro-Cryl Universal Primer, B66W01310
 - b. Two Topcoats: S-W: Pro Industrial Pre-Catalyzed Semi-Gloss Epoxy, K46 Series

D. Wood Substrates: Wood trim; Architectural woodwork; Doors.

1. Latex over Latex Primer System:
 - a. Prime Coat: S-W: Multi-Purpose Latex Primer/Sealer, B51 Series
 - b. Intermediate: S-W: Solo 100% Acrylic Flat, A74 Series
 - c. Topcoat: S-W: Solo 100% Acrylic Semi-Gloss, A76 Series

E. Gypsum Board Substrates:

1. Latex over Latex Sealer System:
 - a. Prime Coat: S-W: ProMar 200 Zero VOC Primer, B28 Series
 - b. Two Topcoats: S-W: ProMar 200 Zero VOC Eg-Shel, B20 Series
 - c. For ceilings provide flat finish.
 - d. For unit bathroom walls, kitchen, and laundry: Provide semigloss finish.
2. Water-Based Light Industrial Coating System: Epoxy-Modified Latex System: At walls indicated as epoxy, and at common bathrooms, storage rooms, maintenance rooms, and janitor closets:
 - a. Prime Coat: Primer sealer, latex, interior.
 - 1) BM; Ultra Spec 500; Waterborne Interior Primer Sealer, N534/K534.
 - 2) PPG; SpeedHide Zero Interior Zero VOC Latex Primer Sealer, 6-4900XI.
 - 3) S-W; ProMar 200 Zero, Interior Latex Primer, B28W02600/B28WQ2600.
 - b. Intermediate Coat: Epoxy-modified latex, matching topcoat.

- c. Topcoat: Epoxy-modified latex, eggshell (MPI Gloss Level 3) (except semi-gloss at toilet rooms and janitor closets).
 - 1) Corotech PRE-CATALYZED Waterborne Epoxy Eggshell (V342)/Semi-Gloss (V341)
 - 2) PPG; Protective and Marine Coatings Aquapon WB EP Epoxy, Semi-Gloss, 98E-1S.
 - 3) Sherwin-Williams, Pro Industrial, Waterbased Precatalyzed Epoxy, Eggshell K45-1150/Semigloss K46-1150.

END OF SECTION

SECTION 099600 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Steel.
 - 2. Interior Substrates:
 - a. Steel.
- B. Related Requirements:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 09 painting Sections for general field painting.

1.2 DEFINITIONS

- A. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: for each type of product indicated. Include preparation requirements and application instructions.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Samples for Verification: for each type of coating system and in each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: for each product indicated, include the following:
 - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 - 3. VOC content.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Low-Emitting Materials: Field applied interior paints and coatings.
 - 3. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide scheduled products or a comparable product by one of the following:
 - 1. Corotech Coatings; Benjamin Moore & Co. (BM).
 - 2. Sherwin-Williams Company (The) (S-W).
 - 3. Tnemec Company, Inc. (TN).

2.3 HIGH-PERFORMANCE COATINGS, GENERAL

- A. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. for each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 - 3. Products shall be of same manufacturer for each coat in a coating system.
- B. Colors: As indicated in color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations for repainting in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Preparation of Existing Surfaces Scheduled for Recoating with High Performance Coatings: Refer manufacturer's recommendations for preparation of substrates with various degrees of deterioration.
- C. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- D. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 7/NACE No. 4, unless otherwise indicated.
 - 2. SSPC-SP 10/NACE No. 3, for handrails and guardrails.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Apply coatings at manufacturer's recommended thicknesses; obtain manufacturer technical representative written recommendations for substrates that vary from normal application conditions.

3. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 4. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 5. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
 - C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.5 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel and Galvanized Steel Substrates:

1. Pigmented Polyurethane over Epoxy Zinc-Rich Primer System:

a. Prime Coat: Primer, zinc-rich, epoxy:

- 1) Benjamin Moore: Corotech Organic Zinc Rich Primer V170.
- 2) PPG: 1K Organic Zinc Rich Primer.
- 3) Sherwin Williams: Zinc Clad III HS 100.

b. Intermediate Coat: Epoxy, high-build, low gloss:

- 1) Benjamin Moore: Polyamide Epoxy Coating
- 2) PPG AQUAPON High Build Polyamide-Epoxy Coating
- 3) S-W Macropoxy 646-100, B58-600 Series,.

c. Topcoat: Polyurethane, two-component, pigmented, gloss:

- 1) Benjamin Moore: Aliphatic Acrylic Urethane.
- 2) PPG AQUACRON WPUT.
- 3) S-W Pro Industrial Waterbased Acrolon 100 Polyurethane, B65-720 Series.

2. Pigmented Polyurethane over Epoxy System MPI EXT 5.1H:

- a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - 1) Benjamin Moore: Corotech; Surface Tolerant Epoxy Mastic Coating, V160.
 - 2) PPG Architectural: Protective and Marine Coatings; Americoat 235.
 - 3) Sherwin Williams: Protective and Marine, Dura-Plate 235 Multi-purpose Epoxy.
- b. Intermediate Coat: Epoxy, gloss, MPI #72 or MPI #77.
 - 1) Benjamin Moore: Corotech; Surface Tolerant Epoxy Mastic Coating, V160.
 - 2) PPG Architectural: Protective and Marine Coatings; Americoat 235.
 - 3) Sherwin Williams: Protective and Marine, Tile-Clad HS Epoxy.
- c. First and Second Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
 - 1) Benjamin Moore: Corotech; Aliphatic Acrylic Urethane, V500.
 - 2) PPG Architectural: Protective and Marine Coatings, Pitthane Ultra Gloss 95-812 Series.
 - 3) Sherwin Williams: Protective and Marine, Acrolon 218 HS.

3.6 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

- 1. Pigmented Polyurethane over Epoxy Primer System MPI INT 5.1F: Handrails.
 - a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
 - 1) Benjamin Moore: Corotech; Surface Tolerant Epoxy Mastic Coating, V160.
 - 2) PPG Architectural: Protective and Marine Coatings; Americoat 235.
 - 3) Sherwin Williams: Protective and Marine, Dura-Plate 235 Multi-purpose Epoxy.
 - b. Intermediate Coat: Polyurethane, two component, pigmented, matching topcoat.
 - c. Topcoat: Polyurethane, two component, pigmented, gloss (MPI Gloss Level 6), MPI #72.
 - 1) Benjamin Moore: Corotech; Aliphatic Acrylic Urethane, V500.
 - 2) PPG Architectural: Protective and Marine Coatings, Pitthane Ultra Gloss 95-812 Series.
 - 3) Sherwin Williams: Protective and Marine, Acrolon 218 HS.

END OF SECTION

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SECTION 101412 – PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Interior and other building-mounted signage required for occupancy by authorities having jurisdiction, including but not limited to:
 - 1. Room and component identification panel signs.
- B. Related Information:
 - 1. Other panel signs and room-identification signs are Owner Furnished/Owner Installed.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For panel signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Panel Signs: Full-size Sample.
 - 2. Room-Identification Signs: Full-size Sample.
- D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.
- E. Sign supplier to provide ONLINE REORDER website for use by owner to order additional signs. Reorder website to include sign descriptions, sign drawings & sign cost.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities, UFAS Uniform Federal Accessibility Standards, and ICC A117.1 for signs.

2.2 MANUFACTURERS

- A. Acceptable Interior/Exterior Signage Product: Comparable to ASI Intac Series
- B. Acceptable Exterior Signage Product: Comparable to ASI Legacy Series OR ASI LPS Series or ASI LTV Series
- C. Available manufacturers offering products comparable to the basis of design products include:

1. ASI Signage Innovations
2. Best Sign Systems, Inc.
3. InPro Corporation (IPC).
4. Mohawk Sign Systems.
5. Nelson-Harkins Industries.

2.3 SIGN MATERIALS

- A. Sign Face: Subsurface Painted acrylic, .125 inch thick, matte first surface.
- B. Applied Lettering and/or Numerals: LPP Series Individual, Acrylic, Dimensional Characters. Individual cut acrylic letters (1/32" thick) with matte finish.
- C. Grade 2 Braille: Clear raster balls D. Fastener: VHB Tape -.030-inch-thick double-face tape.
- D. INSTALLATION METHOD
 1. Tape Mount or Screw Mount w/ Counter Sunk Holes and Silicone. Signs on glass to have vinyl backer. Backers to have counter sunk holes with face piece tape mounted over backer to conceal mounting.
- E. FABRICATION – GENERAL
 1. General: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, and details of construction.
 2. Preassemble signs in the shop to the greatest extent possible to minimize field assembly. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in a location not exposed to view after final assembly.
 3. Conceal fasteners if possible; otherwise, locate fasteners to appear inconspicuous.
 4. Form panels to require size and shape. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.
 5. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.

2.4 FIELD-APPLIED, VINYL-CHARACTER SIGNS

- A. Field-Applied, Vinyl-Character Sign: Prespaced characters die cut from 3- to 3.5-mil (0.076- to 0.089-mm) thick, weather-resistant vinyl film with release liner on the back and carrier film on the front for on-site alignment and application.
 1. Size: As indicated on Drawings.
 2. Substrate: Glass.
 3. Text and Font: As indicated on Drawings.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated or as directed by Architect.
- C. Mounting Methods:
 - 1. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
- D. Field-Applied, Vinyl-Character Signs: Clean and dry substrate. Align sign characters in final position before removing release liner. Remove release liner in stages and apply and firmly press characters into final position. Press from the middle outward to obtain good bond without blisters or fishmouths. Remove carrier film without disturbing applied vinyl film.
 - 1. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.

- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.4 SIGN SCHEDULE

- A. Schedule: Refer to signage schedule and Drawings for sizes, locations, and layout of signage types, sign text copy, and graphics.
- B. Sign Types and Quantities: As indicated on Drawings.
 - 1. Exterior – Parking Signage
 - a. ASI Legacy Series Post and Panel Signs
 - b. 2" x 2" Square Aluminum Posts, Painted one Standard Color
 - c. Direct Burial in Concrete at Grade, Posts 30" Below Grade. Above Grade Measurements Noted Below.
 - d. 1/8" thick Aluminum Panels, Painted (1) Standard Color with Vinyl Graphics
 - 1) Stop Sign: 90" h Post; 30" h x 30" w Panel, Reflective Graphics
 - 2) HC/VA Sign: 84" h Post; 18" h x 12" w & 6" h x 12" w Panel
 - 3) Yield Sign: 90" h Post; 30" h x 30" w Panel, Reflective Graphics
 - 4) Wayfinding Sign: 84" h Post; 18" h x 18" w Panel
- C. Exterior Fire Department Connection Sign: Size, font, and sign material as required by authorities having jurisdiction.

END OF SECTION

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cutout dimensional characters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dimensional letter signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Dimensional Characters: Half-size Sample of each type of dimensional character.
2. Exposed Accessories: Full-size Sample of each accessory type.

D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

A. Cutout Characters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASI Sign Systems, Inc.
 - b. Gemini Incorporated.
 - c. Metal Arts.
 - d. Southwell Company (The).
2. Character Material: Plate aluminum.
3. Character Height: As indicated.
4. Thickness: 1/4 inch, unless otherwise indicated on Drawings.
5. Finishes:
 - a. Integral Aluminum Finish: Clear anodized.
6. Mounting: Projecting studs.
7. Typeface: As indicated on Drawings.

2.2 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.3 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 - 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - 4. Sign Mounting Fasteners:
 - a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

2.4 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

2.5 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
 - 1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate and install washers and nuts on stud ends projecting through opposite side of surface and tighten.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

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SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Corner guards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

C. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details.

D. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long. Include example top caps.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of cover installed, but no fewer than two, 48-inch-long units.
2. Mounting and Accessory Components: Amounts proportional to the quantities of extra materials. Package mounting and accessory components with each extra material.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.
3. Store plastic components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.
 - b. Store wall-guard and handrail covers in a horizontal position.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
 - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
 1. Low-Emitting Materials: Adhesives and Sealants.
 2. Low-Emitting Materials: Walls.
 3. Responsible Sourcing: Recycled content.
 4. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.2 MANUFACTURERS/PRODUCTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide scheduled products or comparable product of one of the following:
 1. Construction Specialties, Inc.
 2. Koroseal Interior Products, LLC.
 3. Nystrom, Inc.
 4. inpro Corporation.
- B. Source Limitations: Obtain wall- and door-protection products from single source from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.4 CORNER GUARDS

- A. Surface-Mounted, Plastic-Cover Corner Guards: Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
 - 1. Cover: Extruded rigid plastic, minimum 0.100-inch wall thickness; in dimensions and profiles indicated on Drawings.
 - 2. Continuous Retainer: Minimum 0.060-inch-thick, one-piece, extruded aluminum.
 - 3. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
- B. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
 - 1. Material: Stainless-steel sheet, Type 304.
 - a. Thickness: Minimum 0.0781 inch.
 - b. Finish: Directional satin, No. 4.
 - 2. Wing Size: Nominal 2-1/2 by 2-1/2 inches.
 - 3. Corner Radius: 1/8 inch.
 - 4. Mounting: Oval head, countersunk screws through factory-drilled mounting holes.
- C. Surface-Mounted End-Wall Guards.
 - 1. Match adjacent corner guards.

2.5 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required; thickness as indicated.
- B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- C. Adhesive: As recommended by protection product manufacturer.

2.6 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.7 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For products attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.
- C. Accessories: Provide accessories required for a complete installation.
 - 1. Provide anchoring devices and suitable locations to withstand imposed loads.

3.4 CLEANING

- A. Immediately after completion of installation, clean products and accessories using a cleaning agent approved by the wall protection product manufacturer.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

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SECTION 102800 – TOILET AND BATH ACCESSORIES – RESIDENT UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bathroom accessories for resident units.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - a. Show blocking and fastening requirements for grab bars.
 - 3. Include electrical characteristics.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to requirements, provide products as shown on the Drawings.

2.2 FABRICATION

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

PART 3 - EXECUTION

3.1 INSTALLATION

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

END OF SECTION

SECTION 102802 - TOILET, BATH, AND LAUNDRY ACCESSORIES, COMMON AREAS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Common areas bathroom accessories.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.
- C. Shop Drawing: Show locations for concealed blocking to accept toilet accessory fasteners.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 COMMON AREAS BATHROOM ACCESSORIES

- A. Basis of Design Products: Provide products indicated as scheduled or comparable product approved by Architect, prior to bid.
- B. Toilet Tissue Dispenser With Shelf:
 - 1. Description: Two-roll unit.
 - 2. Mounting: Surface mounted.
 - 3. Material and Finish: Stainless steel, satin finish.
- C. Combination Paper Towel (Folded) Dispenser/ Disposal Unit
 - 1. Mounting: Semi-Recessed Mount.
 - 2. Dimensions: 17-7/16" W x 56-1/4" H x 4-3/16" D.
 - 3. Capacity: 600 C-fold or 800 multifold towels.
 - 4. Waste Receptacle: Removable 12-gal waste receptacle locks into cabinet.
 - 5. Material and Finish: Stainless steel, satin finish
- D. Liquid-Soap Dispenser:
 - 1. Description: Designed for dispensing soap in liquid form from cartridges.
 - 2. Mounting: Vertically oriented, surface mounted.
 - 3. Application: 1 per single or pair of lavatories.

E. Sanitary Product Disposal Unit:

1. Mounting: Surface mounted.
2. Receptacle: Removable.

F. Grab Bar:

1. Mounting: Flange with concealed fasteners, screwed to concealed blocking.
2. Material: .050 inch thick 304 stainless steel tubing
3. Finish: Polished chrome, with slip-resistant texture in grip area.
4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.
6. Submit sample to Architect for approval.

2.3 WARM-AIR DRYERS

A. Source Limitations: Obtain warm-air dryers from single source from single manufacturer.

B. High-Speed Warm-Air Dryer:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Dryer, Inc.
 - b. Bradley Corporation.
 - c. Excel Dryer Inc.
 - d. World Dryer Corporation.
2. Description: High-speed, warm-air hand dryer for rapid hand drying.
3. Mounting: Surface mounted with low-profile design.
4. Operation: Electronic-sensor activated with operation time of 10 to 20 seconds.
5. Cover Material and Finish: Cast iron, with enamel finish, white.
6. Electrical Requirements: 115 V, 20 A, 2300 W.

2.4 CHILDCARE ACCESSORIES

A. Diaper-Changing Station: ASTM F 2285.

1. Type: Vertical Stainless Steel Recessed-Mounted
2. Basis of Design: Koala Kare KB311-SSRE
3. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
 - a. Engineered to support minimum of 250 lb static load when opened.
4. Mounting: Recessed.
5. Unit Dimensions: 26-7/32-inches W x 41 5/16-inches H
6. Depth (closed): 2-23/32-inches
7. Extension (open): 32-27/32-inches
8. Material and Finish: Stainless steel, No. 4 finish (satin) exterior, with HDPE interior in manufacturer's standard color.
9. Liner Dispenser: Built in.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units' level, plumb, and firmly anchored in locations and at heights indicated.
 - 1. Install all wall mounted units using minimum #8 wood screws penetrating at least 1 inch into solid wood concealed blocking.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

END OF SECTION

SECTION 104116 - EMERGENCY KEY CABINETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Lock box holding keys for fire department use.
- B. Related Information
 - 1. Section 07 9200 "Joint Sealants" for sealing joints between lock box and adjacent construction.

1.2 COORDINATION

- A. Verify lock box requirements with local Fire Department to assure compatibility.
- B. Coordinate location of lock box requirements with local Fire Department.

1.3 ACTION SUBMITTALS

- A. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide the following or product approved by local Fire Department.
 - 1. Knox Company; KnoxBox 3200.

2.2 FIRE DEPARTMENT LOCK BOX

- A. Characteristics:
 - 1. Heavy-duty, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers.
 - 2. Mounting: As selected by Architect.
 - 3. Capacity: Holds 10 keys.
 - 4. Finish: As selected by Architect.
- B. Location: Outside entry where required by authority having jurisdiction.

2.3 INSTALLATION ACCESSORIES

- A. Provide fasteners and anchors not furnished by product manufacturer and required for installation of secure units.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install key box in accordance with manufacturer's written instructions.
- B. Secure key box to solid substrate such as framing, concealed wood blocking, masonry or cementitious panels. Use of hollow wall anchors on gypsum board sheathing is not permitted.

3.2 CLEANING

- A. Clean exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semi-recessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.

D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semi-recessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher and hose valve.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Guardian Fire Equipment, Inc.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Larsens Manufacturing Company.
 - d. Nystrom.
 - e. Potter Roemer LLC; a Division of Morris Group International.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. Recessed Cabinet: Typical:
 - 1. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
- E. Semi-recessed Cabinet: Where recessed cabinet is not compatible with wall construction: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
- F. Cabinet Trim Material: Aluminum sheet.
- G. Door Material: Aluminum sheet.
- H. Door Style: Vertical duo panel with frame.
- I. Door Glazing: Tempered float glass (clear).
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting door pull and friction latch.
 - 2. Provide manufacturer's standard hinge, permitting door to open 180 degrees.
- K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Silk-screened.
 - 3) Lettering Color: Red.
 - 4) Orientation: Vertical.

L. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: As selected by Architect from manufacturer's full range.
2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
 4. Prepare doors and frames to receive locks.
 5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames and grind smooth.

- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for hose valves and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed and semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semi-recessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable fire extinguishers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.
- B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 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.
 - 1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated and where bracket-mounted fire extinguisher is indicated.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Babcock-Davis.
 - 2. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - 3. Larsens Manufacturing Company.
 - 4. Nystrom, Inc.
 - 5. Potter Roemer LLC.
- C. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

- D. Multipurpose Dry-Chemical Type in Steel Container FE: UL-rated 4-A:80-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

- 1. Application: All locations unless otherwise indicated.

2.2 RESIDENTIAL PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: UL listed in compliance with 711A for residential kitchens.

- 1. Basis of Design: Subject to compliance with requirements, provide Kidde Kitchen Fire Extinguisher RESSP
 - 2. Valves: Proprietary valve for high volume, broad dispersal, low velocity.
 - 3. Handles and Levers: Nylon.

- B. Dry-Chemical Type in Aluminum Container: UL-rated Special Purpose, 2.5-lb nominal capacity, with sodium bicarbonate-based dry chemical in enameled-aluminum container.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION

SECTION 105413 – WIRE MESH STORAGE LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal framed wire mesh storage locker units.

1.2 COORDINATION

- A. Coordinate sizes and locations of blocking and backing required for installation of units attached to adjacent construction.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include fabrication details, material descriptions, dimensions of individual components and profiles, and finishes for wire mesh storage lockers.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For wire mesh storage lockers to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1.6 SITE CONDITIONS

- A. Environmental Limitations: Do not deliver or install wire mesh storage lockers until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Responsible Sourcing: Recycled content.
 - 2. Responsible Sourcing: Recyclable Content.
 - 3. Building Product Disclosure and Optimization Documentation, where available for proposed products.

2.2 WIRE MESH STORAGE LOCKERS

- A. Basis of Design: Wire mesh bulk storage lockers manufactured by ULINE.
- B. Construction:
 - 1. Wire Mesh: 8-gauge cold drawn wire mesh, 1 5/16-inch squares.
 - 2. Corner angle supports: 12-gauge cold-rolled steel.
 - 3. Finish: Manufacturer's standard powder coating.
- C. Single Tier, 1 Wide (Product H-8324):
 - 1. Dimensions (W by D by H): 36-inches by 48-inches by 90-inches
- D. Double Tier, 36 by 48-inches (Product H-8325):
 - 1. Dimensions (W by D by H): 36-inches by 49.5-inches by 90-inches
 - 2. Door Opening (W by H): 33-inches by 78-inches
 - 3. Shelf (W by D): 35 1/8-inches by 46 3/8-inches
- E. Accessories: Provide the following accessories:
 - 1. Wire Mesh Tops.
 - 2. Wire Mesh Backs.

2.3 FABRICATION

- A. Fabricate wire mesh storage lockers square and rigid, without distortion. Fabricate connections to form a rigid structure, free of buckling and warping.
 - 1. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
 - 2. Build in straps, plates, brackets, and other reinforcements as needed to support shelf loading.
 - 3. Cut, reinforce, drill, and tap metal fabrications to receive hardware, fasteners, and similar items.
- B. Form metal in maximum lengths to minimize joints. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling."

- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine floors for suitable conditions where wire mesh storage lockers will be installed.
- C. Examine construction to which wire mesh storage lockers will be attached for properly located blocking, grounds, or other solid backing for attachment of support fasteners.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wire mesh storage lockers level, plumb, square, rigid, true, and with shelves flat and free of dents or distortion. Make connections to form a rigid structure, free of buckling and warping.

3.3 ADJUSTING

- A. Adjust wire mesh storage lockers so that connectors and other components engage accurately and securely.
- B. Adjust and lubricate operable components to operate smoothly and easily, without binding or warping. Check and readjust operating hardware.
- C. Touch up marred finishes or replace wire mesh storage lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by wire mesh storage lockers manufacturer.
- D. Replace wire mesh storage lockers that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 105500 - POSTAL SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. USPS-approved horizontal mail receptacles.
 - 2. Accessories:
 - a. Key cabinet.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For postal specialties. Include plans, elevations, sections, details, identification sequence for compartments, and attachments to other work.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Product certificates.
- E. Other Informational Submittals: Final USPS local postmaster approval for installed postal specialties to be served by USPS.
- F. Maintenance data.

1.3 QUALITY ASSURANCE

- A. Source Limitations for Each Type of Postal Specialty: For USPS-approved products, use only those included on current lists of USPS manufacturers and models.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver lock keys to Owner by registered mail or overnight package service with a record of each corresponding lock and key number.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: Manufacturer's standard alloy and temper for type of use and finish indicated.
- B. Steel Sheet: Cold rolled, ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, exposed matte finish where exposed.
- C. Metallic-Coated Steel Sheet: Galvanized-steel sheet, ASTM A 653/A 653M, G60 coating designation, extra smooth where exposed; or electrolytic zinc-coated steel sheet, ASTM A 879/A 879M, Coating Designation 08Z.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304.

- E. Stainless-Steel Anchor Bolts, Nuts, and Washers: ASTM A 193/A 193M, Grade B8M, Type 316.
- F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 USPS-APPROVED HORIZONTAL MAIL RECEPTACLES

- A. Front-Loading, USPS-Approved Horizontal Mail Receptacles: Multiple compartments with fixed, solid compartment backs, enclosed within recessed wall box. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging side-hinged master door to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-STD-4C.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Postal Manufacturing Co.; Division of Postal Products Unlimited, Inc.
 - b. Auth-Florence Manufacturing; a Florence company.
 - c. Bommer Industries, Inc.
 - d. Jensen Industries.
 - e. Salsbury Industries.
 - f. Security Manufacturing Corporation.
 - 2. Compartments: As indicated on Drawings.
 - 3. Front-Loading Master Door: Fabricated from extruded aluminum and braced and framed to hold compartment doors; prepared to receive master-door lock provided by local postmaster.
 - 4. Compartment Doors: Fabricated from extruded aluminum. Equip each with lock and tenant identification as required by cited standard. Provide mail slot in the compartment with master-door lock.
 - a. Compartment-Door Locks: Comply with USPS-L-1172C, PSIN O910, for locks and keys, or equivalent as approved by USPS; with three keys for each compartment door. Key each compartment differently.
 - 5. Frames: Fabricated from extruded aluminum or aluminum sheet; ganged and nested units, with cardholder and blank cards for tenant's identification within each compartment.
 - 6. Snap-on Trim: Fabricated from same material and finish as compartment doors.
 - 7. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.
 - 8. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:
 - a. Anodic Finish: Clear.

2.3 ACCESSORIES

- A. Key Cabinet: Wall-mounted, steel cabinet with pivoting, key-holding panels and side-hinged door equipped with five-pin tumbler, cylinder door lock and concealed, full-length flush hinge. Finish cabinet, panels, and door with baked-enamel or powder-coated finish. Provide key control system consisting of key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers.
 - 1. Capacity: Keys for 150 percent of the number of mail-receptacle locks.
 - 2. Cross-Index System: Index cards for recording key information. Include three receipt forms for each key-holding hook.

3. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

2.4 FABRICATION

- A. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs and safe to touch.
- B. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly.
- C. Form joints exposed to weather to exclude water penetration.
- D. Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
 1. Where dissimilar metals will be in permanent contact with each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation.
 2. Where aluminum will contact grout, concrete, masonry, or wood, protect against corrosion by painting contact surfaces with bituminous coating.
 3. Final acceptance of postal specialties depends on compliance with USPS requirements.
- B. Horizontal Mail Receptacles: Install horizontal mail receptacles with center of tenant-door lock cylinders and bottom of compartments at the maximum and minimum heights above finished floor established by USPS and manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

- A. Arrange for USPS personnel to examine and test postal specialties after they have been installed according to USPS regulations.
- B. Obtain written final approval from USPS postmaster that authorizes mail collection for the served installation.

END OF SECTION

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SECTION 105613 - METAL STORAGE SHELVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Four-post metal storage shelving.

1.2 COORDINATION

- A. Coordinate sizes and locations of blocking and backing required for installation of metal storage shelving attached to wall and ceiling assemblies.
- B. Coordinate locations and installation of metal storage shelving that may interfere with ceiling and wall systems including lighting, HVAC, speakers, sprinklers, access panels, electrical switches or outlets, and floor drains.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal storage shelving.
- B. Shop Drawings: For customized metal storage shelving.
 1. Include plans, elevations, sections, and attachment details.
 2. Include installation details of connectors, lateral bracing, and special bracing.
- C. Product Schedule: For metal storage shelving. Use same designations indicated on Drawings.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal storage shelving to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1.7 SITE CONDITIONS

- A. Environmental Limitations: Do not deliver or install metal storage shelving until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance for Four-Post Metal Storage Shelving: Capable of withstanding the loads indicated according to MH 28.1.

2.2 FOUR-POST METAL STORAGE SHELVING

- A. Open Four-Post Metal Storage Shelving MSS#1: Factory-formed, field-assembled, freestanding system, designed for shelves to span between and be supported by corner posts, with shelves adjustable over the height of shelving unit. Fabricate initial shelving unit with a post at each corner. Fabricate additional shelving units as add-on units, designed to share two corner posts with initial shelving unit. Provide fixed top and bottom shelves, adjustable intermediate shelves, and accessories indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. EQUIPTO.
 - b. Hallowell.
 - c. Penco Products, Inc.
 - d. Republic Storage Systems, LLC.
 - e. Schaefer Systems International, Inc.
 - f. Tensco.
 - g. UNICOR.
2. Load-Carrying Capacity per Shelf: 350 lb.
3. Posts: Fabricated from hot-rolled steel; in manufacturer's standard shape; with perforations at 1-1/2 inches o.c. to receive shelf-to-post connectors.
 - a. Add-On Shelf Posts: Fabricated from hot-rolled steel, manufacturer's standard shape; perforated to match main posts and of same thickness.
 - b. Post Base: Adjustable steel floor plate, drilled for floor anchors.
4. Bracing: Manufacturer's standard, single or double diagonal cross bracing at back and ends; as required for stability, load-carrying capacity of shelves, and number of shelves.
5. End Panels: Fabricated from cold-rolled steel sheet.
 - a. Steel Sheet Thickness, Nominal: As required for load-carrying capacity per shelf.
6. Solid-Type Shelves: Fabricated from steel sheet as follows:
 - a. Steel Sheet Thickness, Nominal: As required for load-carrying capacity per shelf.
 - b. Fabricate fronts and backs of shelves with box-formed edges, with corners lapped and welded.
7. Shelf Quantity: Four shelves per shelving unit in addition to top and bottom shelf.
8. Shelf-to-Post Connectors: Compression clips or Support clips.
9. Base: Closed, with base strips fabricated from same material and with same finish as shelving.
10. Overall Unit Width: 30 inches.
11. Overall Unit Depth: 24 inches.

12. Overall Unit Height: 84 inches.
13. Accessories:
14. Steel Finish: Baked enamel or powder coat.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.3 MATERIALS

- A. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- C. Steel Tubing: ASTM A 513/A 513M, Type 2.
- D. Floor Anchors: Galvanized-steel, post-installed expansion anchors. Provide number per unit recommended by manufacturer unless additional anchors are indicated in calculations.
- E. Wall Anchors: Manufacturer's standard, galvanized-steel anchors designed to secure metal storage shelving to adjacent wall. Provide one per shelving unit for each shelving unit adjacent to a wall unless additional anchors are indicated in calculations.

2.4 FABRICATION

- A. Shop Fabrication: Prefabricate shelving components in shop to greatest extent possible to minimize field fabrication; temporarily preassemble shelving components where necessary to ensure that field-assembled components fit together properly. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate metal storage shelving square and rigid, with posts plumb and true and shelves flat and free of dents or distortion. Fabricate connections to form a rigid structure, free of buckling and warping.
 1. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
 2. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.
 3. Build in straps, plates, brackets, and other reinforcements as needed to support shelf loading.
 4. Cut, reinforce, drill, and tap metal fabrications to receive hardware, fasteners, and similar items.
- C. Form metal in maximum lengths to minimize joints. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
- D. Form edges and corners free of sharp edges or rough areas. Fold back and crimp exposed edges of unsupported sheet metal to form a 1/2-inch-wide hem on the concealed side; ease edges of metal plate to radius of approximately 1/32 inch. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Weld corners and seams continuously to develop strength, minimize distortion, and maintain the corrosion resistance of base metals. At exposed locations, finish welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of

adjacent surface. Weld before finishing components to greatest extent possible. Remove weld spatter and welding oxides from exposed surfaces before finishing.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling."
- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine floors for suitable conditions where metal storage shelving will be installed.
- C. Examine walls and ceilings to which metal storage shelving will be attached for properly located blocking, grounds, or other solid backing for attachment of support fasteners.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Vacuum finished floor and wet mop resilient flooring over which metal storage shelving is to be installed.

3.3 INSTALLATION

- A. Install metal storage shelving level, plumb, square, rigid, true, and with shelves flat and free of dents or distortion. Make connections to form a rigid structure, free of buckling and warping.
 - 1. Install exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 - 2. Install braces, straps, plates, brackets, and other reinforcements as needed to support shelf loading and as required for stability.
 - 3. Anchor shelving units to floor with floor anchors through floor plate. Shim floor plate to achieve level and plumb installation.
 - 4. Connect side-to-side and back-to-back shelving units together.

5. Install shelves in each shelving unit at spacing indicated on Drawings or, if not indicated, at equal spacing.
 - a. Four-Post Metal Storage Shelving: Install four clips, one at each post, for support of each shelf; with clips fully engaged in post perforations.

3.4 ERECTION TOLERANCES

- A. Erect four-post metal storage shelving to a maximum tolerance from vertical of 1/2 inch in up to 10 feet of height, not exceeding 1 inch for heights taller than 10 feet.

3.5 ADJUSTING

- A. Adjust metal storage shelving so that connectors and other components engage accurately and securely.
- B. Adjust and lubricate operable components to operate smoothly and easily, without binding or warping. Check and readjust operating hardware.
- C. Touch up marred finishes or replace metal storage shelving that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal storage shelving manufacturer.
- D. Replace metal storage shelving that has been damaged or has deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 105623 - WIRE CLOSET STORAGE SHELVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes ventilated wire storage shelving.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Indicate locations for wood blocking to support wire shelving.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to requirements, manufacturers whose products may be incorporated in the Work include, but are not limited to, the following:
 - 1. ClosetMaid.
 - 2. Lee Rowan Co.
 - 3. Stanley Storage Systems.
 - 4. Schulte Corp.

2.2 MATERIALS

- A. Steel: C-1008 bright basic cold-drawn steel wire, 100,000 psi tensile strength.
- B. Wire Coating: Manufacturer's standard white pvc or epoxy coating.
- C. Fasteners: Corrosion-resistant wood screws, size recommended by manufacturer to support rated loads.
- D. Wall Anchors: Manufacturer's standard anchors designed to secure wire storage shelving to wall at increments required to support rated loads.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine walls to which wire storage shelving will be attached for properly located blocking, grounds, or other solid backing for attachment of support fasteners.
- B. Install wire shelving after other finishing operations, including painting, have been completed.
- C. Install wire storage shelving level, plumb, square, rigid, true, and with shelves flat and free of dents or distortion. Make connections to form a rigid structure, free of buckling and warping.
 - 1. Install exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

2. Install braces, straps, plates, brackets, and other reinforcements as needed to support shelf loading and as required for stability.

D. Accessories:

1. Garment Hanger Bars: Install one per shelving unit in bedroom and living room closets.

3.2 ERECTION TOLERANCES

- A. Erect wire storage shelving to a maximum tolerance from horizontal of 1/4 inch.

3.3 ADJUSTING

- A. Adjust wire storage shelving so that connectors and other components engage accurately and securely.
- B. Replace wire storage shelving that has been damaged or has deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 107316 – CANOPIES, HANGER-SUPPORTED

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall-hung canopies.

B. Related Information:

1. Section 055000 "Metal Fabrications" for requirements for embedded metal anchoring fabrications furnished under this Section for wall attachment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for canopies.

- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

- C. Shop Drawings: For canopies. Include plans, elevations, sections, details, and attachments to other work.

1. Anchoring Plans: Include location, diameter, and projection of anchor bolts required to attach to building structure. Indicate reactions at each location.
2. Structural-Framing Drawings: Show complete fabrication of primary framing. Indicate welds and bolted connections. Include transverse cross connections.
3. Roof Panel Layout Drawings: Show layouts of panels on support framing, details of edge conditions, joints, panel profiles, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work.

- D. Samples for Verification: For exposed finishes, in manufacturer's standard sizes.

- E. Delegated-Design Submittal: For canopies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Erector and professional engineer.

- B. High Wind Design Certificate and Installation Instructions: Florida DBPR Product Approval or Miami-Dade County Product Control Notice of Acceptance (NOA) for locations outside of High - Velocity Hurricane Zone (HVHZ).

- C. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Erector Qualifications: An experienced erector who is specialized in erecting and installing work similar in material, design, and extent to that indicated for this project and who is acceptable to manufacturer.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- C. Preinstallation Conference: Conduct conference at Project site.

1.6 COORDINATION

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

1.7 WARRANTY

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

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Responsible Sourcing: Recycled content.

2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Super Lumideck manufactured by Mapes Canopies, LLC,, or comparable product of one of the following:
 - 1. AVADek.
 - 2. Dittmer Architectural Aluminum.
 - 3. Architectural Fabrication, Inc.
 - 4. Perfection Architectural Systems, Inc.
- A. High Wind Design Product Approval: Provide products and attachment system with current approval for [Florida DBPR Product Approval](#) or [Miami-Dade County Product Control](#) or acceptable to authorities having jurisdiction.

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design canopies.
- B. Structural Performance: Assemblies shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection Limits: Design framing system to withstand design loads without deflections greater than $L/180$.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 3 for basic protection.
 - 1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.
 - 2. Small-Missile Test: For glazing located between 30 feet (9.1 m) and 60 feet (18.3 m) above grade.

2.4 MATERIALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
 - 1. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M).
 - 2. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).
 - 3. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, standard weight (Schedule 40) unless another weight is indicated or required by structural loads.
 - 4. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M).
- B. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant or noncorrodible units; weather-resistant, tamperproof, vandal- and theft-resistant, compatible, nonstaining materials. Provide as required for walkway covering assembly, mounting, and secure attachment. Number as needed to comply with performance requirements and to maintain uniform appearance; evenly spaced. Where exposed to view, provide finish and color as selected by Architect from manufacturer's full range.
 - 1. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E 488 conducted by a qualified independent testing and inspecting agency.

2. Adhesive-Bonded Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E 1512 conducted by a qualified independent testing and inspecting agency.

- a. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

- D. Hanger Rod: Stainless steel, threaded to allow for adjustment to ensure drainage from canopy as indicated.

- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

- A. Fabrication, General: Fabricate members to dimensions, elevations, and details indicated on drawings and approved submittals. Beams and columns shall be factory welded with neatly mitered corners into one-piece rigid bents. All welds shall be smooth and uniform. Grind welds where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Rigid mechanical joints shall be used when shipping limitations prohibit the shipment of fully welded bents.

- B. Beams, and Fascias: Extruded aluminum sections of sizes and shapes indicated.

- C. Fascia: Profile as indicated on Drawings.

- D. Flashing: Not less than 0.040 inch thick aluminum.

- E. Decking: Deck shall be manufactured of roll formed modules that interlock in a self-flashing manner. Deck shall be assembled with sufficient camber to offset dead load deflection.

1. Deck shall be self-flashing sections interlocking into a composite unit.

2. Configuration: [Corrugated][x-inch flat][x-inch v-groove][x by x flat][x by x standing seam].

- F. Gutter: Aluminum extrusion of sufficient size to drain water based upon local requirements.

- G. Fasteners: 316 stainless steel.

- H. Allow for installation of electrical conduit, lighting, plumbing, sprinkler components, and similar items concealed above decking.

2.6 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

2.7 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Match Architect's sample of solid color non-exotic, non-metallic finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify all dimensions existing and provided.

3.2 INSTALLATION

- A. High Wind Design Installation: Install canopies in accordance with High Wind Design Product Approval and approved shop drawings.
- B. Install canopies with positive and negative slope of 1/8 inch per foot to allow water drainage from top of canopy to draining scuppers/downspouts and eliminate ponding water
- C. Hanger Rod: Attach hanger rod to imbedded anchor plate in accordance with approved shop drawings.
- D. Beams:
 - 1. Level tops of beams to receive roof panels; roof panels shall drain rainwater into beams as indicated.
 - 2. Minor connections and incidental details shall be as shown on the drawings.
 - 3. Ensure that end caps are welded or mechanically fastened securely into place.
- E. Decking:
 - 1. Install level and square to beams to avoid "out of square" conditions at beam ends.
 - 2. Secure each contact point with a minimum of three stainless steel fasteners with 3/4 inch (19 mm) flat neoprene washers.
- F. Joints Sealants and Flashing:
 - 1. Seal fabrication joints and seams away from view where required.
 - 2. Seal all other points where water penetration might be expected.
 - 3. Flash connection to walls where walkway cover units contact surface of building: do not use sealant.

3.3 CLEANING

- A. Remove protective film from members. Clean canopy of dirt, grease, handprints, and other blemishes. Leave area in a neat, clean, and acceptable condition.
- B. Protect canopy from damage from other construction operations. Provide temporary barricades where necessary.

END OF SECTION

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SECTION 112429 – FACILITY FALL PROTECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Permanently-installed fall protection systems, including:
 - 1. Rooftop lanyard anchors.
- B. Related Requirements:
 - 1. Section 055500 "Metal Fabrications" for miscellaneous metal supports for facility fall protection components.

1.2 COORDINATION

- A. Embedded and Concealed Items: Coordinate installation of anchorages for facility fall protection components. Furnish setting drawings, templates, and directions for installing anchorages, including blocking, sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry or concealed within framed construction. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each product:
 - 1. Manufacturer's product lines of mechanically connected components.
 - 2. Fasteners and accessories.
- B. Shop Drawings: Show locations and layout of fall protection components; include dimensioned plans, elevations, sections, and details of connection to building structure.
- C. Delegated-Design Submittal: For fall protection components, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.5 COORDINATION

- A. Coordinate selection of fall protection and fall restraint devices and attachment provisions with Owner's safety program and Owner-provided personal protection equipment.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design fall protection components, including attachment to building construction.
- B. Occupational Safety and Health Standards: Provide fall protection components complying with requirements of 29 CFR 1910.23, including structural performance.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

2.2 ROOFTOP LANYARD ANCHORS

- A. Roof Deck-Mounted Single-Point Anchors: Pipe stanchion, minimum 18 inches high, 2-inch-ID, welded to steel base plate minimum 12 by 12 by 3/8 inches, with tie-off loop at top of pipe and attached pass-through engineered and fabricated to receive attachments for personal fall protection equipment complying with 29 CFR 1910.23 requirements.
 - 1. Configure base plate anchors and associated fasteners for steel roof deck minimum 0.0295 inch/ 24 ga. thick.
 - 2. Basis of Design Product: [GF Protection, Inc., Guardian CB-12.](#)

2.3 MATERIALS, STEEL

- A. Provide galvanized finish for all steel and cast iron components.
- B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
- D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 FITTINGS AND FASTENERS

- A. General: Provide Type 304 or Type 305 stainless-steel fasteners.

2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.6 FABRICATION

- A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

- B. Form work true to line and level with accurate angles and surfaces.
- C. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- D. Form changes in direction by inserting prefabricated elbow fittings.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Brackets, Flanges, Fittings, and Anchors: Provide brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

2.7 STEEL AND IRON FINISHES

- A. Galvanized Items:
 - 1. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - 2. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set fall protection components accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set components plumb within a tolerance of 1/8 inch in 3 feet.
 - 3. Align horizontal members so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.2 ANCHORING ROOFTOP LANYARD ANCHORS

- A. Fasten anchor base plate to roof deck with size and type of fasteners recommended by anchor manufacturer for application, using fastener holes in base plate.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION

SECTION 113100 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cooking appliances.
 - 2. Refrigeration appliances.
 - 3. Cleaning appliances.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Samples: For each exposed product and for each color and texture.
- D. Product certificates.
- E. Field quality-control reports.
- F. Warranties: Sample of special warranties.
- G. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.
- B. Sole Source: Provide residential appliances purchased through a single supplier capable of providing manufacturer-authorized warranty service for all units.

1.4 WARRANTY

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Gas-Fueled Appliances: Not applicable.

- C. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

2.2 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113 "Sustainable Design Requirements," including the following:
 - 1. ENERGY STAR: Comply with requirements for ENERGY STAR product labeling where indicated.

2.3 MANUFACTURERS

- A. Basis-of-Design Product: Provide products indicated in Schedule on Drawings or comparable products by one of the following:
 - 1. General Electric Appliances.
 - 2. LG Appliances.
 - 3. Maytag; a division of Whirlpool Corporation.
 - 4. Whirlpool Corporation.
- B. Comparable products will be evaluated on the salient characteristics, including, but not limited to, the following;
 - 1. Dimensions, especially where appliances must fit cabinetry or adjacent construction.
 - 2. Material and finish.
 - 3. Appearance, especially where appliances are used in same room.
 - 4. Capacity.
 - 5. Functionality, ease of use, and durability.
 - 6. Power requirements.
 - 7. Plumbing requirements.
 - 8. Compliance with energy and water conservation standards.
 - 9. Compliance with accessibility standards.

2.4 APPLIANCES: Refer to Schedule on Drawings:

- A. Refrigerator/Freezer, Top Freezer: Energy Star certified.
- B. Refrigerator/Freezer, Bottom Freezer, ADA: Energy Star certified.
- C. Refrigerator/Freezer, French Door: Energy Star certified.
- D. Electric Range.
- E. Electric Range, ADA.
- F. Range Hood: Venting.
- G. Range Hood, ADA: Venting. ADA controls kit.
- H. Clothes Washer: Stacking. Energy Star certified.
- I. Clothes Washer, ADA: Front Load. Energy Star certified.
- J. Clothes Dryer, Electric: Stacking.

- K. Clothes Dryer, Electric, ADA: Front Load.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- C. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.
- D. Utilities: See Divisions 22 and 26 for plumbing and electrical requirements.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After installation, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- C. Prepare test and inspection reports.

END OF SECTION

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SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations. Indicate required blocking.

C. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark inside face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 inches long.

E. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products of MechoShade Systems, Inc; or comparable products by one of the following:
 - 1. Draper Inc.
 - 2. Hunter Douglas Contract.
 - 3. Lutron Electronics Co., Inc.
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Manufacturer's standard meeting WCMA A 100.1.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Chain tensioner, jamb mounted.
 - 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Roller Drive-End Location: Right side of inside face of shade.
 - 2. Direction of Shadeband Roll: Regular, from back of roller.
 - 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

2.3 SHADEBAND MATERIAL

A. Shadeband Material: Light-filtering fabric.

1. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.

B. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches.
2. Endcap Covers.
3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.4 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Basis of Design: Mechoshade, Ecoveil Sheer.
2. Type: PVC-free polyester.
3. Weave: Basketweave.
4. Openness Factor: 3 percent.
5. Color: As selected by Architect from manufacturer's full range.

2.5 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by

railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 123530 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Kitchen cabinets.
 - 2. Vanity cabinets.
- B. Related Information:
 - 1. Section 064113 "Wood Architectural Cabinets" for cabinets in first floor units where required by FEMA Technical Bulletin 2.

1.2 SUBMITTALS

- A. Product Data: For cabinets, countertop material, and cabinet hardware.
- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.
- C. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, methods of joining countertops, and cutouts for plumbing fixtures.
- D. Samples: For each type of material exposed to view.

1.3 QUALITY ASSURANCE

- A. Quality Standards: Unless otherwise indicated, comply with the following standards:
 - 1. Cabinets: KCMA A161.1.
 - 2. Cabinet Doors and Drawer Fronts: Solid wood.

PART 2 - PRODUCTS

2.1 CABINETS

- A. Basis of Design Products: CabinetWorks Group, Advanta Cabinets.
 - 1. Construction: All wood cabinet box
 - 2. Face Style: Full Overlay
 - 3. Door and Drawer Style: Shaker or Slab Face as selected by Architect.
 - 4. Exposed Cabinet Ends: Match Cabinet Face
 - 5. Finish: Painted finish from manufacturers standard colors

2.2 CABINET HARDWARE

- A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.
- B. Install cabinets without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.
- C. Install casework level and plumb to a tolerance of 1/8 inch in 8 feet.
- D. Fasten cabinets to adjacent units and to backing.
 - 1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.
- E. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

END OF SECTION

SECTION 123661 - SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid-surface-material countertops and backsplashes.
 - 2. Quartz agglomerate countertops and backsplashes.

1.2 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOPS

- A. Configuration: Provide countertops with the following front and backsplash style:
 - 1. Front: Profile indicated on Drawings.
 - 2. Backsplash: Straight, slightly eased at corner.
 - 3. Endsplash: Matching backsplash.
- B. Countertops: 1/2-inch-thick, quartz agglomerate with front edge built up with same material.
- C. Backsplashes: 1/2-inch-thick, quartz agglomerate.

2.2 SOLID-SURFACE-MATERIAL COUNTERTOPS

- A. Configuration: Provide countertops with the following front and backsplash style:
 - 1. Front: Profile indicated on Drawings.
 - 2. Backsplash: Straight, slightly eased at corner.
 - 3. Endsplash: Matching backsplash.
- B. Countertops: 1/2-inch- (12.7-mm-) thick, solid surface material with front edge built up with same material.
- C. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material.
- D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate with loose backsplashes for field assembly.

2.3 COUNTERTOP MATERIALS

- A. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.
- B. Adhesives: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.
 - 1. Colors and Patterns: Provide scheduled products.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

END OF SECTION

SECTION 12 93 00 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. ADA Pool Lift
- B. Bike Parking Shelter
- C. Bike Rack

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. Shop Drawings:
 - 1. Shop drawings shall show all details including dimensions, radius, materials, quantities, and manner of assembling and fastening of the various members, properly coordination with the related work.
 - 2. Shop drawings shall show true profiles, attachments to other works, methods of anchoring hardware, if any, and all other necessary information.
 - 3. Delegated-design Shop Drawings of Custom Bike Shelter: Contractor to submit engineered shop drawings indicating all structural details though plans, sections and detail drawings. Shop drawings shall show all details including sizes, materials, quantities and manner of assembling and fastening of the various members, properly coordinated with the related work. shop drawings shall show true profiles, attachments to other work, methods of anchoring hardware, if any, and all other necessary information.
- C. Samples: Submit manufacturer's samples of materials, finishes, and colors.

1.3 QUALITY ASSURANCE

- A. Delivery: Deliver products to site in manufacturer's original, unopened containers and packaging. Upon delivery, examine packages immediately to ensure all products are complete and undamaged.
- B. Storage: Store products in a protected, dry area in manufacturer's unopened containers and packaging.
- C. Handling: Protect product's finish from damage during handling and installation.

- D. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. ADA Pool Lift:

1. Model: Splash Pool Lift
 - a. Lifting Capacity: 400 lbs
 - b. Mounting: See details
 - c. Finish: White
2. Manufacturer:
 - a. SR Smith
Toll Free (800) 824-4387.
Website <https://www.srsmith.com/en-us/>
E-mail: srs.potechsupport@fluidra.com

B. Bike Rack:

1. Type:
 - a. Bola (Over Concrete Paving)
 - 1) Exposed Height: 32 inch.
 - 2) Embedded Leg Length: 6 inch
 - 3) Mounting: Embedded (See Drawing)
 - 4) Finish: Stainless Steel
2. Manufacturer:
 - a. Landscape Forms, Inc.,
7800 E Michigan Avenue, Kalamazoo, Michigan 49048.
Toll Free (800) 430-3209.
Phone (985) 869-0341.
Fax (269) 381-3455.
Website www.landscapeforms.com.
E-mail: mallarym@landscapeforms.com

C. Bike Shelter:

1. Type: Customized Bike Shelter
 - a. Size: Refer to drawings
 - b. Mounting: Refer to drawings
 - c. Material & Finish: Powdercoated Steel
 - d. Color: To Be Selected From Manufacturer's Standard Color Chart
2. Manufacturer:

- a. Due-Gard
40442 Koppernick Rd.
Canton MI 48187-4279
Call: 616.881.1617
Email: jwalters@duo-gard.com
Website: jwalters@duo-gard.com

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Take field measurements prior to fabrication, where possible.
- B. Install site furnishings level, plumb, true, securely anchored and positioned at locations indicated on Drawings. All site furnishings shall be laid out in the field and approved prior to installation.
- C. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
- D. Restore damaged finishes and protect work.

END OF SECTION 12 93 00

SECTION 142123 - MACHINE-ROOM-LESS ELECTRIC TRACTION PASSENGER ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes machine-room-less electric traction passenger elevators.

- 1. Passenger elevator.
- 2. Service elevator

1.2 ACTION SUBMITTALS

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

- 1. Include Product Data for car enclosures, hoistway entrances, operation, control, and signal systems.

- B. Sustainable Design Submittals: Submit verification of compliance with sustainability requirements categories listed in Part 2 in accordance with Section 018113.

- C. Shop Drawings:

- 1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
- 2. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

- D. Samples: For each type of exposed finish involving color selection.

1.3 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.
- B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway and pit layout and dimensions, as indicated on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
- C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard five-year maintenance agreement, starting on date initial maintenance service is concluded.

1.5 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Product: Subject to compliance with requirements, provide Kone Elevators and as follows:
 - 1. Elevator 1 (Passenger): Kone Monospace 300 DX, 2500 lb. capacity.
 - 2. Elevator 2 (Service): Kone Monospace 500 DX, 5000 lb. capacity

2.2 SUSTAINABILITY REQUIREMENTS

- A. Sustainability Requirements: Comply with the requirements for material selection categories applicable to Project as indicated in Section 018113, including the following:
 - 1. Low-Emitting Materials: Adhesives and Sealants.
 - 2. Responsible Sourcing: Recycled content.
 - 3. Responsible Sourcing: Recyclable Content.

2.3 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with requirements for accessible elevators in the United States Access Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.
- C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and shall comply with elevator seismic requirements in ASME A17.1/CSA B44.
 - 1. Project Seismic Design Category: Refer to Structural Drawings.
 - 2. Elevator Component Importance Factor: 1.0.

2.4 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Elevator 1 (Passenger) Description:
 - 1. Rated Load: 2500 lb.
 - 2. Rated Speed: 150 fpm.
 - 3. Operation System: Selective-collective automatic operation.
 - 4. Auxiliary Operations:
 - a. Standby power operation.

- b. Standby-powered lowering.
- c. Battery-powered automatic evacuation.
- d. Earthquake Emergency Operation: Comply with requirements in ASME A17.1/CSA B44.
- e. Automatic dispatching of loaded car.
- f. Nuisance-call cancel.
- g. Loaded-car bypass.
- h. Distributed parking.
- i. Off-peak operation.
- j. Automatic operation of lights and ventilation fans.
- k. Priority service at all floors.
- l. Security Features: Card-reader operation.

1) Security features shall not affect emergency firefighters' service.

5. Car Enclosures:

- a. Inside Width and Inside Depth: As indicated on Drawings; meet local requirements for emergency medical service stretchers.
- b. Inside Height: Not less than 93 inches to underside of ceiling.
- c. Front Walls (Return Panels): Satin stainless steel.

6. Car Fixtures:

- a. Side and Rear Wall Panels: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
- b. Reveals: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
- c. Door Faces (Interior): Satin stainless steel, ASTM A480/A480M, No. 4 finish.
- d. Door Sills: Aluminum.
- e. Ceiling: Satin stainless steel, ASTM A480/A480M, No. 4 finish Polished bronze, lacquered.
- f. Handrails: 1-1/2 inches (38 mm) round satin stainless steel, at rear of car.
- g. Floor recessed and prepared to receive scheduled floor finish.

7. Hoistway Entrances:

- a. Dimensions: As indicated on the Drawings.
- b. Type: As indicated on the Drawings.
- c. Frames: Satin stainless steel.
- d. Doors: Satin stainless steel.

8. Hall Fixtures: Satin stainless steel, No. 4 finish.

9. Additional Requirements:

- a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
- b. Provide hooks for protective pads and one complete set(s) of full-height protective pads.

C. Elevator 2 (Service) Description:

- 1. Freight Loading Class for Service Elevator(s): Class A.
- 2. Rated Load: 4000 lb.
- 3. Rated Speed: 150 fpm.
- 4. Operation System: Selective-collective automatic operation.

5. Auxiliary Operations:
 - a. Standby power operation.
 - b. Standby-powered lowering.
 - c. Battery-powered automatic evacuation.
 - d. Earthquake Emergency Operation: Comply with requirements in ASME A17.1/CSA B44.
 - e. Automatic dispatching of loaded car.
 - f. Nuisance-call cancel.
 - g. Loaded-car bypass.
 - h. Distributed parking.
 - i. Off-peak operation.
 - j. Automatic operation of lights and ventilation fans.
 - k. Priority service at all floors.
 - l. Independent service for service elevator.
 - m. Security Features: Card-reader operation.
 - 1) Security features shall not affect emergency firefighters' service.
6. Car Enclosures:
 - a. Inside Width and Inside Depth: As indicated on Drawings; meet local requirements for emergency medical service stretchers.
 - b. Inside Height: Not less than 93 inches to underside of ceiling.
 - c. Front Walls (Return Panels): Satin stainless steel.
7. Car Fixtures:
 - a. Side and Rear Wall Panels: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
 - b. Reveals: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
 - c. Door Faces (Interior): Satin stainless steel, ASTM A480/A480M, No. 4 finish.
 - d. Door Sills: Aluminum.
 - e. Ceiling: Satin stainless steel, ASTM A480/A480M, No. 4 finish Polished bronze, lacquered.
 - f. Handrails: 1-1/2 inches (38 mm) round satin stainless steel, at rear of car.
 - g. Floor recessed and prepared to receive scheduled floor finish.
8. Hoistway Entrances:
 - a. Dimensions: As indicated on the Drawings.
 - b. Type: As indicated on the Drawings.
 - c. Frames: Satin stainless steel.
 - d. Doors: Satin stainless steel.
9. Hall Fixtures: Satin stainless steel, No. 4 finish.
10. Additional Requirements:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
 - b. Provide hooks for protective pads and one complete set(s) of full-height protective pads.

2.5 TRACTION SYSTEMS

- A. Elevator Machines: Permanent magnet, variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.
 - 1. Provide regenerative system that complies with the IgCC.
 - 2. Limit total harmonic distortion of regenerated power to 5 percent per IEEE 519.
- B. Fluid for Hydraulic Buffers: Fire-resistant fluid.
- C. Machine Beams: Provide steel framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Section 055000 "Metal Fabrications" for materials and fabrication.
- D. Car Frame and Platform: Bolted- or welded-steel units.
- E. Guides: Roller guides or polymer-coated, nonlubricated sliding guides. Provide guides at top and bottom of car and counterweight frames.

2.6 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.
- B. Auxiliary Operations:
 - 1. Single-Car Battery-Powered Automatic Evacuation: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it moves to the next floor above or below, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
 - 2. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after five minutes and are re-energized before car doors open.

2.7 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

2.8 CAR ENCLOSURES

- A. General: Provide enameled or powder-coated steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.
 - 1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
- B. Materials and Finishes: Manufacturer's standards, but not less than the following:
 - 1. Subfloor:
 - a. Exterior, underlayment grade plywood, not less than 5/8-inch (15.9-mm) nominal thickness.

2. Floor Finish: Refer to the Drawings.
3. Stainless-Steel Wall Panels: Flush, formed-metal construction; fabricated from stainless-steel sheet.
4. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled or powder-coated steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
5. Sight Guards: Provide sight guards on car doors.
6. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
7. Metal Ceiling: Flush panels, with four low-voltage downlights in each panel. Align ceiling panel joints with joints between wall panels.
8. Light Fixture Efficiency: Not less than 35 lumens/W.
9. Ventilation Fan Efficiency: Not less than 3.0 cfm/W.

2.9 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
 1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.
 1. Fire-Protection Rating: 1 hour.
- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
 1. Stainless-Steel Frames: Formed from stainless-steel sheet.
 2. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet or by laminating stainless-steel sheet to exposed faces and edges of enameled or powder-coated steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
 3. Sight Guards: Provide sight guards on doors matching door edges.
 4. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
 5. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.10 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide vandal-resistant buttons and lighted elements illuminated with LEDs.
- B. Car-Control Stations: Provide manufacturer's vandal-resistant recessed or semirecessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
 1. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Hall Push-Button Stations: Provide one hall push-button station at each landing.
 - 1. Manufacturer's vandal-resistant wall-mounted units, for mounting above entrance frames.
- E. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
- F. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.11 FINISH MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- D. Stainless-Steel Bars: ASTM A 276, Type 304.
- E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
- F. Aluminum Extrusions: ASTM B 221, Alloy 6063.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Examine hoistways, hoistway openings, and pits as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- B. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.
- C. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.

- D. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- E. Locate hall signal equipment for elevators as follows unless otherwise indicated:

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

3.4 PROTECTION

- A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:
 - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
 - 2. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
 - 3. Engage elevator Installer to provide full maintenance service.
 - 4. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair, or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity.

END OF SECTION

SECTION 149182 - TRASH CHUTES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Waste chutes.
2. Waste doors.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for metal supporting framework at floor penetrations.
2. Section 076200 "Sheet Metal Flashing and Trim" for roof-vent flashing.
3. Section 077200 "Roof Accessories" for prefabricated roof curbs.
4. Section 211313 "Wet-Pipe Sprinkler Systems" for fire-suppression water-service connections to automatic sprinklers in the chute.
5. Section 221116 "Domestic Water Piping" for water-service connections to chute-flushing or -sanitizing equipment.

1.2 DEFINITIONS

- A. Access Door: Door other than an intake or discharge door that penetrates the chase wall for service access to devices in the chase.
- B. Chase: The shaft that encloses a chute.
- C. Discharge Door: Door or hatch at the bottom of a chute, through which materials exit the chute.
- D. Intake Door: Door or hatch that penetrates the chase wall and chute, and through which materials are fed into the chute.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chutes.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include each type and location of intake, discharge, and access door.
4. Include diagrams for power, signal and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Size and construction of chase enclosing each chute; locations for power, signal, and control wiring; and sprinkler-piping and water-service connections.
 - 2. Chute-discharge locations coordinated with compactor-intake or container locations.
- B. Product Certificates: For each type of chute.
- C. Field quality control reports.

1.6 CLOSEOUT SUBMITTALS

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

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project, include, but are not limited to, the following:
 - 1. Chutes International.
 - 2. Wilkinson-Hi-Rise.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing and inspecting agency, for fire-protection ratings indicated.
 - 1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
 - 2. Intake Doors: Labeled, 1-1/2-hour fire-resistance rated with 30-minute temperature rise of 250 deg F.
 - 3. Access Doors: Labeled, 1-1/2-hour fire-resistance rated with 30-minute temperature rise of 250 deg F.
- C. Discharge-Door Assemblies: Labeled, 1-1/2-hour fire-resistance rated according to NFPA 252 or UL 10B requirements for fire-rated door assemblies.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- E. Standard: Provide chutes complying with NFPA 82 unless otherwise indicated.

2.3 WASTE CHUTES

- A. Chute Metal: Type 304 stainless steel, ASTM A240/A240M.

- 1. Thickness: 0.0625 inch.

- B. Chute Size: 24-inch diameter.

2.4 WASTE DOORS

- A. Intake-Door Assemblies: ASTM A240/A240M, Type 304, stainless steel self-closing units with positive latch and latch handle, with stainless steel trim; constructed as required for performance requirements indicated; and with frame suitable for the enclosing chase construction.

- 1. Door Type: Hopper.
- 2. Size: Manufacturer's standard size for door type, chute type, and diameter indicated.
- 3. Finish: Manufacturer's standard satin or ASTM A480/A480M No. 3 directional polish.
- 4. Mechanical Interlocks: Interlock system for system servicing, operated from discharge door to automatically lock intake doors.

- B. Discharge-Door Assemblies: Aluminum-coated steel; direct vertical-discharge type, inclined, and horizontally closing and latching; constructed as required for performance requirements indicated; and equipped with 165 deg F fusible links that cause doors to close in the event of fire.

- C. Detector System: Heat- and smoke-detecting interlock system with temperature-rise elements that locks chute doors when temperature in chute reaches a predetermined, adjustable temperature.

- 1. Locate smoke detector outside discharge door with solenoid to close discharge door.

- D. Access-Door Assemblies: Manufacturer's standard ASTM A240/A240M, Type 302/304, stainless steel doors with trim; constructed as required for performance requirements indicated; with frame suitable for the enclosing chase construction; in satin or ASTM A480/A480M No. 3 directional polish finish; equipped with cylinder locks that release latch with keys that are removable only when cylinder is locked.

- 1. Lock Cylinder: Cylinders standard with manufacturer.
- 2. Keying: Key access-door cylinders alike.
- 3. Keys: Two for each cylinder.

- E. Manual Control System: Control system with manual switches that lock chute doors during shutdown hours and service operations.

2.5 ACCESSORIES

- A. Chute Fire Sprinklers: NFPA 13; manufacturer's standard, recessed, automatic, NPS 1/2 sprinklers; ready for piping connections.

- B. Flushing Spray Unit: NPS 3/4 spray-head unit located in chute above highest intake door, ready for hot-water piping connection, and with access door for spray-head and piping maintenance.

- C. Intake-Door Baffles: Rubber baffles, 1/8 inch thick.

- D. Sound Dampening: Manufacturer's standard sound-deadening coating on exterior of chute sound and vibration isolator pads at supporting frame at each floor penetration.

2.6 FABRICATION

- A. Factory-assemble chutes to greatest extent practicable with nonleaking, continuously welded or lock-seamed joints without bolts, rivets, or clips projecting into chute interior. Include intake-door assemblies, metal supporting framing at each floor, and chute expansion joints between each support point.
- B. Offsets: Construct offsets where indicated on Drawings. Fabricate so that installed chute is without obstructions that might prevent materials from free falling within chute.
 - 1. Offsets below Intake Doors: Unless otherwise indicated, do not exceed a 15-degree maximum offset angle at any point, or place offset closer than 48 inches to nearest door above offset.
 - 2. Offset above Top Intake Door: Do not exceed a 45-degree maximum offset angle between the highest intake door and the upper termination of chute.
 - 3. Offsets at Floors: Complete offset between floors by returning chute to plumb before penetrating floors.
 - 4. External Reinforcing: Externally reinforce impact area of offsets located below top intake door. Install vibration isolators where braced to structure.
- C. Roof Vent: Fabricate vent unit as full-size extension of chute, open to the atmosphere. Extend vent to height above roofing surface as indicated on Drawings. Equip vent with full insect screening and metal explosion-release cap. Fabricate with roof-deck flange, counterflashing, and clamping ring of nonferrous metal compatible with chute metal.
- D. Chute Fire Sprinklers: Install internally within chute, recessed out of the chute area through which material travels, and according to NFPA 13. Locate fire sprinklers at or above the top intake door of chutes, within the chute at alternate floor levels in buildings more than two stories tall, and at the lowest service level.
- E. Equipment Access: Fabricate chutes with access for maintaining equipment located within the chute, such as flushing and sanitizing units, fire sprinklers, and plumbing and electrical connections.

PART 3 - EXECUTION

3.1 INSTALLATION OF WASTE CHUTES

- A. Install and test chutes before installing enclosing chase construction.
- B. Install chutes[**and diverters**] according to NFPA 82 and manufacturer's written instructions. Assemble components with tight, nonleaking joints. Anchor chutes securely to supporting structure to withstand impacts and stresses. Install chute and components to maintain fire-resistive performance of chute and the enclosing chase construction.
- C. Install chutes plumb, without obstructions that might prevent materials from free falling within chutes.
- D. Anchor flanges of chute vents to roof curbs before installing roofing and flashing. Install chute-vent counterflashing after roofing and roof-penetration flashing are installed.

3.2 INSTALLATION OF WASTE DOORS

- A. Intake and Discharge Doors: Interface door units with throat sections of chutes for safe, snag-resistant, sanitary depositing of materials in chutes.
 - 1. Coordinate installation of foot-pedal door operator with installation of door and the enclosing chase construction.
 - 2. Interconnect sanitizer control with door interlock system.

3.3 FIELD QUALITY CONTROL

- A. Test chute components after installation.
 - 1. Operate doors, locks, and interlock systems to demonstrate that hardware operates properly and smoothly and electrical wiring is connected correctly.
 - 2. Complete test operations before installing chase enclosures.
- B. Test heat- and smoke-sensing devices for proper operation.
- C. Inspections:
 - 1. Fire-rated door inspections: Inspect each fire-rated door according to NFPA 80, section 5.2
 - 2. Repair or remove and replace door installations where inspections indicate that they do not comply with specified requirements.
 - 3. Reinspect repaired or replaced doors to determine if replaced or repaired door installations comply with specified requirements.
 - 4. Prepare and submit separate inspection report for each fire-rated door indicating compliance with each item listed in NFPA 80 and NFPA 101.
- D. Plumbing Access Doors: After construction of chase enclosure, verify that access doors have been correctly located and properly installed for their purpose.

3.4 ADJUSTING

- A. Adjust doors for smooth and balanced movement.

3.5 CLEANING

- A. After completing chase enclosure, clean exposed surfaces of chute system's components. Do not remove labels of testing and inspecting agencies.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain each chute and related equipment.

END OF SECTION

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SECTION 21 05 00

FIRE PROTECTION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 21 Fire Sprinkler Systems.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories
 - 2. National Fire Protection Association
 - 3. State Health Department
 - 4. Local Municipal Building Inspection Department
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. Obtain all permits required.

1.3 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.4 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.
- B. As-Built drawings should indicate the following information as a minimum:
 - 1. Indicate all addendum changes to documents.
 - 2. Remove Engineer's seal, name, address and logo from drawings.
 - 3. Mark documents RECORD DRAWINGS.
 - 4. Clearly indicate: DOCUMENT PRODUCED BY
 - 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, etc. that were deviated from construction drawings.
 - 6. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 - 7. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
 - 8. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
 - 9. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 - 10. Cloud all changes.

1.5 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.6 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.7 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.8 GUARANTEE

- A. Guarantee work for one (1) year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.9 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers.

1.10 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.11 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 21 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval.

1.12 OPERATING TESTS

- A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections.

1.13 WARRANTIES

- A. Submit all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.14 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
 - 1. Provide the training during the Owner's regular working day.
 - 2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.

3.3 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
 - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.4 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION

SECTION 21 05 12

FIRE PROTECTION SHOP DRAWINGS, COORDINATION DRAWINGS AND PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1.
- B. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- C. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: $\frac{1}{4}" = 1'-0"$.
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
 - 1. Actual mechanical equipment and components to be furnished
 - 2. Service clearance
 - 3. Relationship to other equipment and components
 - 4. Roof drains and leader piping
 - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
 - 1. Ductwork shop drawings
 - 2. Coordination drawing specified in Division 26

- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Manufacturer's catalog numbers
 - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
 - 1. Proper sizes and capacities
 - 2. That the item will fit in the available space in a manner that will allow proper service
 - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
 - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
 - 2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect / Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name and address
 - 4. The number of each Shop Drawing, Project Datum and Sample submitted
 - 5. Other pertinent data
- D. Submittals shall include:
 - 1. The date of submission
 - 2. The project title and number
 - 3. Contract Identification
 - 4. The names of:
 - a. Contractor
 - b. Subcontractor
 - c. Supplier
 - d. Manufacturer
 - 5. Identification of the product
 - 6. Field dimensions, clearly identified as such
 - 7. Relation to adjacent or critical features of the work or materials
 - 8. Applicable standards, such as ASTM or federal specifications numbers
 - 9. Identification of deviations from contract documents
 - 10. Suitable blank space for General Contractor and Architect / Engineer stamps
 - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
 - 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
 - 2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
 - 1. The related specification section number
 - 2. The exact specification section title
- B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
 - 1. Indicate that the document or sample is a re-submittal
 - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
- C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
 - 1. Review identified submittals with reasonable promptness and in accordance with schedule
 - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
 - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
 - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
 - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 21 05 13

ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electrical provisions to be provided as fire protection work are indicated in other Division 21 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as fire protection, specified or partially specified in this Section, include but are not necessarily limited to the following:
 - 1. Motors for fire protection equipment.
 - 2. Starters for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 3. Wiring from motors to disconnect switches or junction boxes for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 4. Wiring of field-mounted float control switches, flow control switches, and similar fire protection-electrical devices provided for fire protection systems, to equipment control panels.
 - 5. Pipe heat tracing.
- C. Refer to Division 21 sections for specific individual fire protection equipment electrical requirements.
- F. Refer to Division 26 sections for motor starters and controls not furnished integrally with fire protection equipment.
- G. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of fire protection equipment.

1.2 RELATED WORK

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

1.3 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of fire protection work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.
- B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

- A. Provide motors for fire protection equipment manufactured by one of the following:
 - 1. Baldor Electric Company.

2. Century Electric Div., Inc.
 3. General Electric Co.
 4. Louis Allis Div.; Litton Industrial Products, Inc.
 5. Lincoln Electric
 6. Marathon Electric Mfg. Corp.
 7. Reliance Electric Co.
 8. Westinghouse Electric Corp.
- B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of fire protection equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of fire protection work:
- C. Temperature Rating. Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation).
- D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.
- E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 21 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
- F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
- G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
1. Frames. NEMA #56.
 2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 21 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
 3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 21 for other enclosure requirements.
 4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
 5. Noise Rating: Provide "Quiet" rating on motors.
- H. All motors shall be premium efficiency.

2.2 EQUIPMENT FABRICATION

- A. Fabricate fire protection equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in fire protection work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Verify voltage with Electrical Plans.

END OF SECTION

SECTION 21 10 00

FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Design coordination of sprinkler work with the installations of other trades as shown on their drawings; all mechanical, electrical, plumbing and sprinkler work must fit the space requirements. The sprinkler work shall comply with other Sections of this specification; and fit the structure finishes. The Sprinkler Contractor will comply with all the codes and underwriter authorities, and the requirements for the installation of inside and outside piping; including sprinkler heads, valves, tamper switches, flow switches, hangers and supports, sleeves, fire department connections, inspector test connections, main drain and accessories, signs and any other component parts reasonably incidental to providing a complete protection system. Provide 100 percent coverage for the entire building.
- B. A wet system shall be installed in heated areas.
- C. Furnish all articles of a completed sprinkler system including all materials, labor, tools, equipment, transportation services and supervision fees.
- D. The plans provide a riser assembly location at water entry into building for flow switch locations, valve locations (with tamper switches), fire department test assemblies and fire department Siamese connections. These are a guide for subsequent preparation of the Contractor's detailed installation drawings of the complete fire protection sprinkler system which shall be submitted to the Architect / Engineer for review.
- E. The installation of the entire Sprinkler Systems shall comply with all rules and regulations of the National Board of Fire Underwriters, the Local Building Code, Local Fire Marshall, and Requirements of NFPA Pamphlet 13, and other local authorities exercising jurisdiction.
- F. Study the general, structural, electrical and mechanical drawings and specifications, in order to become familiar with the building and details as they apply to the work of this Section. Cooperate with all Trades so that there will be no conflict of space. Plumbing flow lines, large ductwork HVAC piping and electrical service feeders shall take precedence over Fire Protection work, except where it is absolutely necessary to maintain coverage protection.

1.2 BASIS OF DESIGN

- A. National Fire Protection Association (NFPA), latest edition of NFPA 13, Standard for the Installation of Sprinkler Systems.
- B. Vertical zone valves installed in horizontal position are not acceptable. All zone valves are to be located at water entry into building and mounted in the vertical riser.

1.3 QUALITY ASSURANCE

- A. Sprinkler equipment and installation to be in accordance with recommendations of and approved by local, state and federal fire authorities.
- B. Equipment and installation to meet requirements of NFPA No. 13, 14, 20, 24, 25, 70 and 72.
- C. Use materials and equipment that are new and of unused, approved by NFPA and as listed in the UL list of "Inspected Fire Protection Equipment and Materials."

1.4 SHOP DRAWINGS

- A. Make complete shop drawings and working drawings of equipment furnished, including detailed drawings of piping and sprinkler head locations.
- B. The Architect's approval of shop drawings shall not relieve the responsibility of correctly figured dimensions or any errors that may be contained in these drawings. The omission of any material shown on the contract drawings, or specified from the shop drawings, even though approved, shall not relieve the responsibility to furnish and erect them.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Tyco Fire Products
 - 1. Anvil
 - 2. Gem
 - 3. Central
- B. Automatic Sprinkler Company of America
- C. Potter Roemer, Inc.
- D. The Reliable Automatic Sprinkler Company
- E. Viking Corporation
- F. Victaulic Company of America

2.2 PIPING AND FITTINGS

- A. Above Slab Inside Building. Schedule 40, black steel pipe conforming to ASTM A 795 or ASTM A135 joined with threaded fittings.
- B. Underground within five feet of building. Provide ductile iron pipe, Class 200 conforming to ASTM, and ring-tite fittings. Provide concrete thrust blocks at changes in direction, according to the pipe manufacturer's recommendations.
- C. Fittings used to join pipe shall be listed fabricated fittings or manufactured in accordance to the material and dimension standards listed in table 6.4.1 NFPA 13 and 2.2.1 NFPA 14.

2.3 SPRINKLER HEAD

- A. All sprinklers shall comply with the latest requirements of NFPA 13 with respect to orifice size.
- B. All heads shall be UL listed and FM approved, and comply with the latest requirements of NFPA 13 with respect to orifice size unless otherwise noted. Sprinkler heads with "O" ring design shall not be acceptable.
- C. Exposed areas: Standard upright type with escutcheon, with 155 degree F temperature. Tyco Model TY-B, TY-FRB, or equal. Sprinkler head and escutcheon color to be white.
- D. Sidewall applications: Horizontal sidewall type escutcheon. Unfinished areas and recessed with chrome plated escutcheon with 155 degree F temperature rating. Tyco Model TY-B, TY-FRB, or equal. Sprinkler head and escutcheon color to be white.
- E. Suspended ceilings: Adjustable concealed type heads with manufacturer painted cover plate with glass bulb fusible link, with 155 degree F temperature rating. Tyco Model RFII or equal. Cover plate color to be white.

- F. Sprinklers subject to mechanical injury shall be protected with fusible solder type sprinklers and listed guards. Bulb type sprinklers will not be acceptable for these locations.

1. Storage rooms with exposed structure.
2. Mechanical and Electrical rooms.
3. Below exposed stairs.

- G. Systems serving sloped attic spaces shall utilize Tyco Model BB, SD, HIP sprinklers or equal.

2.4 INSPECTOR'S TEST CONNECTION

- A. Provide UL Listed inspector's test connection as required by NFPA 13. Ductile iron module housing with combination sight glass, orifice and bonnet assembly

2.5 TAMPER SWITCH / SUPERVISORY SWITCH

- A. Provide Tamper switch on each valve that controls or shuts off the sprinkler system or any portion thereof. The Tamper switch shall be either one single pole, double throw switch or two single pole, double throw switches as required. Switch shall be compatible with installed valve for standard mounting.

2.6 FLOW SWITCH

- A. Provide Vane type flow switch.
 1. Self-contained pneumatic, adjustable retard.
 2. Two, single pole, double throw switches.
 3. Red enamel tamper proof switch housing with flow paddle.
 4. Potter Roemer Model No. 6200, or approved equal.

2.7 FLOORS AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.8 VALVES

- A. Use valves suitable for 175 psig WOG.
- B. Valves to be UL listed and FM approved.
- C. Valve Connections:
 1. Provide valves suitable to connect adjoining piping as specified for pipe joints. Use full line size valves unless noted otherwise.
 2. Screwed ends for pipe sizes 2 inches and smaller.
 3. Flanged ends for pipe sizes 2-1/2 inches and larger.
 4. Solder or screw to solder adapters for copper tubing.
 5. Use grooved body valves with mechanical grooved jointed piping.
- D. Gate Valves:
 1. Up to 2 inches, bronze, outside screw and yoke, rising stem, solid wedge, screwed ends, manufactured by: Mueller, or approved equal.
 2. Over 2 inches, iron body, bronze trim, outside screw and yoke, rising stem, solid wedge, flanged ends; manufactured by Mueller, or approved equal.
- E. Check Valves:
 1. Up to 2 inch, bronze, regrind bronze swing disk, solder or screwed ends; 200 WOG, manufactured by Mueller, or approved equal.
 2. Over 2 inch, iron body bronze trim, swing disk, regrind – renew bronze disk and seat, flanged ends; 200 WOG, manufactured by Mueller, or approved equal.

- F. Butterfly Valve: Lug body style, bubble-tight shutoff, cast iron body, ASTM B 148 bronze disk, with integral tamper switch, manufactured by Anvil Model No. 8000 FP, or approved equal.
- G. Wall post-adjustable indicating valve: Outside building at water entry location into building, consisting of UL/FM, non-rising stem gate valve and indicator. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle and tamper switch wired to main fire alarm control panel.

2.9 ELECTRIC ALARM BELL

- A. 10-inch round red enamel steel bell with electrically operated vibrating outdoor alarm bell, UL listed, red enamel steel, manufactured by Simplex, or approved equal. Provide power as required for bell.

2.10 GAUGES

- A. Gauges shall be bourdon tube type with minimum 4-1/2 inch dial and die cast aluminum case with screwed ring and black enamel finish. The movement shall be all stainless steel with Grade A phosphor bronze bourdon tube, brazed at socket and tip. The accuracy of the gauge shall be within one-half of one percent of the scale range. The pointer shall be the micrometer adjustment type recalibrated from the front. Pressure and compound gauges shall have suitable scale ranges and graduations. Suitable for temperatures up to 120 degrees F.
- B. Gauges shall have 1/4 inch connections and be mounted with combination stop / snubber needle valve with suitable pressure rating. Scale ranges: 0-200 psi.
- C. Gauge range shall be such that system normal operating pressure falls with 25 percent and 75 percent of the full-scale range.
- D. Pressure scale graduations shall read in psig. Figure intervals shall be in – 20 psig increments, with minor divisions in 2 psig increments.
- E. The accuracy of the gauge shall be at least 0.5 percent of the scale range. Gauge shall be made in accordance with ASME B40.1 accuracy grade 2A.

2.11 SPARE SPRINKLER HEAD BOX

- A. Provide baked enamel steel box to store each type of sprinkler head based on the below numbers for emergency replacement. Numbers below are for each type of head. Provide sprinkler wrench.
 - a. Less than 300 heads: 6 spare heads
 - b. 300 to 1,000 heads: 12 spare heads
 - c. More than 1,000 heads: 24 spare heads.

2.12 ALARM CHECK VALVE

- A. Provide Variable UL listed check valve for City Supplied systems pressure trim set.

2.13 WATER MOTOR ALARM

- A. Provide a red enamel motor alarm for installation on exterior wall.
 - 1. Tyco Model WMA-1 or approved equal.

2.14 SIAMESE FIRE DEPARTMENT CONNECTION

- A. Provide a 4" X 2-1/2" x2-1/2" Siamese Wall mounted rough chrome plated Siamese. Include caps, sillcock, chain, and a plate lettered AUTO-SPKR.

PART 3 - EXECUTION

1.1 DESIGN

- A. Design, spacing of sprinkler heads and selection sizes shall conform to the requirements of NFPA 13 for the indicated occupancy.
- B. Design and install the system so that no part will interfere with doors, windows, heating, mechanical, lighting or electrical equipment. Do not locate sprinkler heads closer than 3 feet to lighting fixtures or other obstructions.
- C. Uniform discharge density design shall be based on hydraulic calculations using the method outlined in NFPA 13. Density of discharge from sprinkler heads shall conform to NFPA 13.
- D. Friction losses in pipe will be based on a value of "C" = 120 in the Hazen and Williams formula.

1.2 LOCATION

- A. Heads shown, if indicated on reflected ceiling plans, are an integral part of the ceiling design. Where heads are not shown or indicated, locate them in the exact center of acoustical ceiling tile unless noted otherwise. In rooms with monolithic plaster or gypsum drywall ceilings, locate the sprinkler heads symmetrically arranged with respect to both axes of the room. Locate sprinkler heads in relation to specialty ceiling elements such as slats, ribs, panels, grids, etc., if not shown on the drawings. Generally, locate heads in the exact center of, or spaced between, such elements. Center heads in corridors.
- B. Locate heads as may be required for coordinated ceiling pattern, even though number of heads exceed minimum code requirements.
- C. Sprinkler heads located in utility or mechanical rooms, penthouses, service corridors, or other such spaces not subject to public view need not be centered in ceiling patterns and may use a straight drop from branch line.
- E. Sprinkler heads shall be installed above and below a catwalk, ductwork, or any other obstruction over 48 inches wide, in exposed areas, per NFPA 13.

1.3 INSTALLATION

- A. Run piping concealed above furred ceilings and in joists to minimize obstructions. Expose only heads.
- B. Protect sprinkler heads against mechanical injury with standard guards.
- C. Locate system drains and inspector's test connections in utility rooms, mechanical rooms or other readily accessible areas not requiring access through ceiling. Coordinate sprinkler system drain flow rates with plumbing system drainage capacities.
- D. Locate outside alarms on wall of building and coordinate with Architect.
- E. Provide on interior wall near sprinkler valve, cabinet containing extra sprinkler heads of each type and wrench suitable for each head type.
- F. Install pipe markers to identify fire protection.
- G. Provide shield or deflector for sprinklers or equipment where electrical switchgear, switchboards and motor control centers are in sprinkler protected spaces.

- H. Install fire 2-1/2 inch department valve, maximum 5 feet above floor, complying with NFPA 14.
- I. Furnish and install, next to the sprinkler riser main, a print sheet protected by glass or a transparent plastic cover, giving brief instructions regarding control, emergency procedure, and other data required by NFPA #13. For hydraulically designed sprinkler systems, a placard is to be permanently attached to the riser indicating the location, and the basis of design (discharge density and system demand).
- J. Do not install exposed piping below structure in public area.

1.4 COORDINATION

- A. Coordinate the installation schedule for this work with the construction schedule for the Work to ensure orderly progress with minimum delay.
- B. Coordinate interface of fire sprinkler system with the work of other trades to ensure proper and adequate provision for the installation and connection of this system.
- C. Coordinate location and quantity of Siamese connections required for fire department connection with Architect and local fire officials.

1.5 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.
- B. Provide supports both sides of elbows for pipe 6" and larger.
- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed.
- D. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Steel Max. Support Spacing, Feet	Minimum Rod Diameter, Inches
1" & smaller	6	1/4
1-1/4" & 1-1/2"	8	1/4
2"-5"	10	3/8
6" and above	10	1/2

1.6 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:
 - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
 - 2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the

installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

- C. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.
- D. Caulk sleeves water and airtight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
- E. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view.

1.7 CLEANING OF PIPING SYSTEMS

- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.

1.8 FLUSHING AND TESTING

- A. Testing and flushing of installation of sprinkler system shall be in accordance with NFPA 13, and NFPA 25.
- B. Flush sprinkler piping in accordance with NFPA 13. Additionally, flush all alarm valves, and all main piping up to valve.
- C. In addition to NFPA 13 required tests, provide flow switch test and tamper switch test for each device, and verify alarm valve operation.

1.9 PIPE MARKERS

- D. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- E. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- F. Install identification in the following locations:
 - 1. Both sides of penetrations through walls, floors and ceilings.
 - 2. Close to valves or flanges.
 - 3. Intervals on straight pipe runs not to exceed 50 feet
 - 4. Apply marker where view is obstructed.
- G. Pipe markers shall meet or exceed the specifications of the ASME A13.1 "Scheme for Identification of Piping Systems".
- H.

1.10 TESTING AND ACCEPTANCE

- A. Prior to connecting to the overhead sprinkler piping, flush the underground main. Secure required approvals of the flushing operations.
- B. Upon completion of the fire sprinkler system installation, test and retest the complete installation and make corrections as necessary to obtain acceptance by the Fire Marshall and/or any other authority having jurisdiction. Furnish test equipment and personnel required.

1.11 TRAINING

- A. At a time mutually agreed upon, provide instruction to the Owner's designated personnel on the operation and maintenance of the automatic sprinkler system and associated equipment. Owner's Operation and Maintenance Manual prepared for this project shall be used during the instruction.

END OF SECTION

SECTION 21 10 00

WATER BASED FIRE SUPPRESSION SYSTEMS

1.1 NITROGEN GENERATOR SYSTEMS

- A. Provide all required labor, materials, equipment and services necessary for a complete and operational Corrosion Management Program for the fire protection systems (FPS) as hereinafter described and as indicated on the drawings.
- B. Corrosion Management Work may include the following listed products and services:
 - 1. Corrosion Management Products shall be as specified herein:
 - a. ECS Protector Nitrogen Generator (PGEN series)
 - b. ECS Protector Dry SMART Vent (PSV-D)
 - c. ECS Protector SMART Gas Analyzer (SGA-1)
 - d. ECS AdvancedIQ Vent Controller (AVC-1)
 - e. ECS In-Line Corrosion Detector (ILD-X)
 - 2. Installation of air compressor and FPS air maintenance device.
 - 3. Installation of corrosion management products.
 - 4. Miscellaneous piping, fittings, couplings, valves, etc. as required.
 - 5. Coordination of work and schedules with other trades.
 - 6. System pressure testing.
 - 7. System commissioning.
- C. All corrosion management work shall be designed, installed, inspected, tested and maintained in accordance with all applicable codes, referenced standards, documents listed herein, the manufacturer's instructions and the provisions of this specification:
 - 1. NFPA 13, Standard for the Installation of Sprinkler Systems
 - 2. NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems
- D. All corrosion Monitoring Devices shall be provided to achieve compliance with NFPA 13, Standard for the Installation of Sprinkler Systems and shall be UL 2987 listed for monitoring corrosion in fire sprinkler systems.
- E. Equipment and components not specifically specified shall be FM Approved or listed by Underwriter's Laboratories, Inc. for FPS installation.
- F. All fire sprinkler system components shall be installed free of rust/corrosion or visible damage. All items not complying with this requirement shall be replaced at no cost to the Owner.
- G. The fire sprinkler contractor shall not pursue any interpretations of the Corrosion Management Program except through the Engineer.
- H. ECS Protector Nitrogen Generator
 - 1. The fire sprinkler contractor shall furnish and install an ECS Protector Nitrogen Generator (PGEN) at each fire sprinkler riser room to service all dry/pre-action zones or as directed by the design engineer. Install per manufacturer's instructions.
 - 2. The ECS Protector Nitrogen Generator (PGEN) must be installed with a compressor sized appropriately for the application and capable of achieving system pressure within 30 minutes in accordance with the requirements of NFPA 13, Standard for the Installation of Sprinkler Systems. When the ECS Protector and the compressor are serving more than a single riser room, a larger capacity compressor may be required.

3. As an integral component in the Dry Pipe Nitrogen Inerting (DPNI) process the ECS Protector Nitrogen Generator shall be designed to achieve a nitrogen concentration of 98% or greater within 14 days of start-up and maintain that concentration within the FPS continuously. The output nitrogen quality shall be confirmed by using an ECS Protector Handheld Gas Analyzer (PHGA-1).
4. The fire sprinkler contractor shall install an ECS Protector Dry SMART Vent (PSV-D) on each dry/pre-action sprinkler system riser to facilitate oxygen removal.
5. Water discharge from a 1/4 in. condensate drain connection on ECS Protector Nitrogen Generator (PGEN) shall be piped to a floor drain or building exterior.
6. The ECS Protector Nitrogen Generator requires a dedicated 120V AC power supply.
7. The Nitrogen Generator shall provide the following monitoring output points: nitrogen generator running mode, bypass mode, nitrogen generator on (presence of power), leak monitor, nitrogen line pressure (analog) that shall be connected to building information or management system.
8. Provide spare filter replacement kit for each ECS Protector Nitrogen Generator to be used during first annual preventative maintenance procedure.
9. Provide Engineered Corrosion Solutions Consulting Services Package for commissioning of the ECS Protector Nitrogen Generator System and to provide operation and maintenance training to facility personnel once commissioning has been completed.

I. Wall Mount Generator

1. The Nitrogen Generator shall be wall mounted with integral oil-less air compressor, rated for continuous duty with an outlet pressure rating of 100 psig, sized in accordance with the manufacturers requirements.
2. The integral air compressor shall be capable of producing a continuous volume of compressed air that is sufficient to fill the largest fire protection system being supplied by the air compressor to operating pressure within thirty (30) minutes in accordance with NFPA 13 requirements and meet the compressed air requirements of the nitrogen generator it is supplying.
3. Wall mount nitrogen generators with integral air compressors shall not require an air receiver tank.

J. Air Compressor:

1. The fire sprinkler contractor shall furnish and install a simplex air compressor to supply air to the Nitrogen Generator.
2. The air compressor shall be splash lubricated reciprocating compressor with an on-board after cooler and rated by the manufacturer for continuous duty service.
3. The air compressor shall have a dedicated un-switched power source sized as directed by the design engineer. The power source must be coordinated with the available power supply (as required by the air compressor manufacturer).
4. Each compressor power source shall include a service disconnect installed adjacent to the air compressor.
5. The air compressor shall have an output pressure rating of at least 150 psig.
6. The air compressor shall be capable of producing a continuous volume of compressed air that is sufficient to fill the largest system being supplied by the air compressor to operating pressure within thirty (30) minutes in accordance with NFPA 13 requirements and also meet the compressed air requirements of the nitrogen generator it is supplying.
7. Air compressor shall be equipped with an air receiver tank of at least 120 gallons and tank shall be equipped with an automatic blow down device that empties condensate from the air receiver tank. This water discharge shall be piped to a floor drain or building exterior per local requirements.
8. Air compressor shall be connected to the ECS Protector Nitrogen Generator (PGEN) with minimum 1/2 in. diameter black steel piping.

K. Air Maintenance Device:

1. The fire sprinkler contractor shall furnish and install an approved air maintenance device for each automatic fire sprinkler system.
2. Air maintenance device shall be equipped with a field adjustable pressure regulator for use in setting the maximum system pressure.
3. Air maintenance device shall be installed per the manufacturer's instructions.

L. ECS Protector Dry SMART Vent (PSV-D):

1. The fire sprinkler contractor shall furnish and install ECS Protector Dry SMART Vent (PSV-D) for each automatic fire sprinkler system. Install per manufacturer's instructions.
2. The piping between FPS and ECS Protector Dry SMART Vent must not create a water trap; the connecting piping must drain when FPS is drained, or PSV-D cannot properly function.
3. A 1/2 in. outlet is required to attach the vent assembly to the FPS.
4. Install ECS Protector Dry SMART Vent on the system side of the dry/pre-action valve on the sprinkler system riser or at the locations shown on the design documents or commissioning drawings.
5. The isolation ball valve of the ECS Protector Dry SMART Vent shall be closed during hydrostatic and/or air pressure testing of the FPS and then placed in the open position for the commissioning and operation of the ECS Nitrogen Generator.
6. The ECS Protector Dry SMART Vent (PSV-D) is equipped with a solenoid valve and separate electric control box. A dedicated 120V AC power supply is required at the electric control box.
7. The electric control box shall be wall-mounted and installed adjacent to the sprinkler system riser.
8. The solenoid valve shall be wired to the electric control box per NFPA 70 and local requirements.

M. ECS AdvancedIQ Vent Controller (AVC-1)

1. The fire sprinkler contractor shall furnish and install an AdvancedIQ Vent Controller to automatically control oxygen venting in each FPS individually and as directed by the design engineer.
2. The vent controller shall be capable of monitoring and controlling the oxygen venting in multiple FPS individually.
 - a. Monitor sprinkler system pressure and nitrogen purity as well as perform leak rate, pressure and purity checks.
 - b. Automatically control the oxygen venting process.
 - c. Store all information in removeable historical data storage.
3. The controller shall include an LCD display to access all functions of the vent controller including the historical data on an individual system basis.
4. The controller shall include a common supervisory output signal.
5. The controller shall be installed in the fire sprinkler valve room to sample gas from oxygen removal vents on multiple FPS in accordance with manufacturer's instructions.
6. Each FPS shall be supplied with a PAV-DQ oxygen removal vent installed on the sprinkler riser at the locations shown on the drawings.
 - a. The oxygen removal vent shall have an adjustable pressure regulator to prevent accidental depressurization of the fire sprinkler system should a disruption occur to the air/nitrogen supply.
 - b. The oxygen removal vent shall have a connection to attach and sample the purity of nitrogen within the FPS.
 - c. The piping between FPS and oxygen removal vent must not create a water

trap; the connecting piping must drain when FPS is drained or the oxygen removal vent will not function properly.

d. A 1-inch outlet is required to attach the vent assembly to the FPS.

7. The contractor shall mount the vent controller to a vertical wall within fifty (50) feet of all of the oxygen removal vents connected to the controller.
8. The vent controller shall be powered by a 120VAC power supply. Coordinate power requirements and location with electrical contractor. The vent controller power supply shall be in accordance with national and local requirements, and NFPA 70.
9. The contractor shall attach and affix 5/32 in. gas supply tubing from push fitting on the oxygen removal vent to corresponding push fitting on the vent controller. Gas supply tubing provided by manufacturer.
10. The oxygen sensing element of the fixed gas analyzer shall have a minimum useful life of ten (10) years.

N. ECS In-Line Corrosion Detector (ILD-X):

1. The fire sprinkler contractor shall furnish and install an In-Line Corrosion Detector (ILD) and as directed by the design engineer. Install in accordance with manufacturer's instructions.
2. The ILD shall be U.L. 2987 listed for use in a fire sprinkler system.
3. Device location shall be determined by design engineer, equipment manufacturer or as show on drawings.
4. The ILD shall be a minimum of eighteen (18) inches long and equipped with rolled groove ends for installation within the FPS piping network.
5. The ILD corrosion detection surface shall be a minimum of six (6) inches long covering the entire circumference of the pipe and be no more than thirty-five (35) thousandths of an inch thick.
6. The ILD shall match the FPS pipe material (black/galvanized), pipe schedule, and pipe diameter at the installation location.
7. The ILD shall be equipped with DPDT Form C contacts that is capable of indicating when the ILD has been activated.
8. The ILD shall be provided with a local battery powered annunciator. The annunciator shall be capable of surface or flush mounting and have a push-to-test function.

O. ECS Protector SMART Gas Analyzer (SGA-1):

1. The fire sprinkler contractor shall furnish and install ECS Protector SMART Gas Analyzer (SGA-1) with each Nitrogen Generator System or as directed by the design engineer. Install per manufacturer's instructions. Device location shall be determined by design engineer or ECS Specification Staff.
2. An ECS Protector Dry SMART Vent (PSV-D) provides the source gas for the ECS Protector SMART Gas Analyzer.
3. The contractor shall mount the ECS Protector SMART Gas Analyzer to a vertical wall within twenty (20) feet of the ECS Protector Vent.
4. The contractor shall provide 24V DC or 120V AC power supply and signal output line in 1/2 in. conduit piped to inlet port on top of ECS Protector SMART Gas Analyzer enclosure.
5. The contractor shall attach and affix 5/32 in. gas supply tubing from push fitting on the ECS Protector Vent to corresponding push fitting on the ECS Protector SMART Gas Analyzer. Gas supply tubing provided by ECS commissioning engineer.
6. The contractor shall connect the 0-5V DC, 0-10V DC, or 4-20mA signal output line to a dedicated supervisory circuit on the building management system.
7. The ECS Protector SMART Gas Analyzer (SGA-1) is equipped with a digital display.

P. The system shall complete and shall comply with all requirements of the manufacturer's requirements. The pre-engineered Nitrogen Generator system shall be as manufactured by Engineered Corrosion Solutions (ECS), St. Louis, Mo or approved equal.

EXECUTION

1.2 NITROGEN GENERATOR SYSTEM

- A. Coordinate closely with the General Contractor, other trades and the Owner to expedite construction, commissioning and avoid interference.
- B. For the Dry Pipe Nitrogen Inerting (DPNI) products specified ECS Specification Staff shall provide on-site supervision and training during the execution of the ECS Consulting Services Package for Commissioning.
- C. Contact Engineered Corrosion Solutions, 11336 Lackland Road, St. Louis, MO 63146, phone: (314) 432-1377, e-mail: info@ecscorrosion.com to schedule system commissioning at least two (2) weeks in advance.
- D. Perform air pressure leakage test in accordance with NFPA 13. Systems that do not meet requirements must be corrected prior to system commissioning.
- E. Confirm Nitrogen Generator meets manufacturer's acceptable output flow rate and nitrogen purity.
- F. Manually activate pressure switch of In-Line Corrosion Detector to confirm proper signal received by monitoring system.
- G. Tests shall be witnessed by Owner's authorized agent.

PART 2 - PART 2 - PRODUCTS – NOT USED

PART 3 - PART 3 – EXECUTION – NOT USED

END OF SECTION

SECTION 21 10 12

STANDPIPE FIRE PROTECTION SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Design coordination of fire standpipe work with the installations of other trades as shown on their drawings; all mechanical, electrical, plumbing work must fit the space requirements. The fire standpipe work shall comply with other Sections of this specification; and fit the structure finishes. The Fire Protection Contractor will comply with all the codes and underwriter authorities, and the requirements for the installation of inside and outside piping; including fire hose rack, valves, tamper switches, flow switches, hangers and supports, sleeves, fire department connections, main drain and accessories, signs and any other component parts reasonably incidental to providing a complete protection system. Provide 100 percent coverage for the entire building.
- B. A wet standpipe system shall be installed and insulated in areas subject to freezing.
- C. Furnish all articles of a completed standpipe system including all materials, labor, tools, equipment, transportation services and supervision fees.
- D. The plans provide a riser/valve location at all stairwells and inside building. All shut-off valve locations (with tamper switches), fire department test assemblies and fire department Siamese connections. These are a guide for subsequent preparation of the Contractor's detailed installation drawings of the complete fire protection system which shall be submitted to the Architect / Engineer for review. Submit only drawings and calculations bearing the approval of the authority having jurisdiction.
- E. Install fire protective system identification signs in accordance with NFPA-14
- F. It shall be the fire protection installer's responsibility, prior to bid, to verify pressure at the project site by performing a flow test. Determine if the available static pressure, residual pressure and flow rate will adequately provide the fire extinguishing system with the necessary operating requirements or if a fire pump, storage tank and necessary appurtenances are required. Notify Architect and Engineer if low water flow / pressure condition exist and inform them of all options prior to proceeding.
- G. The installation of the entire Fire Standpipe System shall comply with all rules and regulations of the National Board of Fire Underwriters, the Local Building Code, Local Fire Marshall, and Requirements of NFPA Pamphlet 14, and other local authorities exercising jurisdiction.
- H. Study the general, structural, electrical and mechanical drawings and specifications, in order to become familiar with the building and details as they apply to the work of this Section. Cooperate with all Trades so that there will be no conflict of space. Plumbing flow lines, large ductwork HVAC piping and electrical service feeders shall take precedence over Fire Protection work.
- I. Provide heat tracing and insulation for wet pipes exposed to freezing conditions.

1.2 BASIS OF DESIGN

- A. National Fire Protection Association (NFPA), latest edition of NFPA 14, Standard for the Installation of Standpipe Systems.

1.3 QUALITY ASSURANCE

- A. Fire Standpipe System equipment and installation to be in accordance with recommendations of and approved by local, state and federal fire authorities.
- B. Equipment and installation to meet requirements of NFPA No. 14, 20, 24, 25, 70 and 72.
- C. Use materials and equipment that are new and of unused, approved by NFPA and as listed in the UL list of "Inspected Fire Protection Equipment and Materials."

1.4 SHOP DRAWINGS

- A. Make complete shop drawings and working drawings of equipment furnished, including detailed drawings of piping standpipes, fire department valves, fire hose cabinets and/or fire hose rack locations. Drawings shall show construction details and dimensions of each piece of equipment and work to be installed. The location of standpipes, fire department valves, fire hose cabinet and fire hose racks shall be as approved. Where additional equipment and piping is required to meet NFPA 14, provide at no additional cost.
- B. Before the shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the departments.
- C. The Architect's approval of shop drawings shall not relieve the responsibility of correctly figured dimensions or any errors that may be contained in these drawings. The omission of any material shown on the contract drawings, or specified from the shop drawings, even though approved, shall not relieve the responsibility to furnish and erect them.
- D. The drawings show the location of the water entry into building. Prepare the fire standpipe drawings under the work of this Section.

1.5 ACCEPTABLE MANUFACTURERS

- A. Johnson Controls (Tyco Fire Products)
 - 1. Gem
 - 2. Central
- B. Mueller
- C. Potter Roemer, Inc.
- D. Victaulic Company of America

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

- A. Above Slab Inside Building
 - 1. Pipe 2" and Smaller. Schedule. 40, black steel pipe conforming to ASTM A 795 or ASTM A135 joined with threaded fittings.
 - 2. Pipe 2-1/2" and larger, provide ASTM A795 or ASTM A135 UL and FM listed.
 - a. Schedule. 40, black steel pipe joined with rolled grooved fittings.
- B. Underground within five feet of building. Provide ductile iron pipe, Class 200 conforming to ASTM, and ring-tite fittings. Provide concrete thrust blocks at changes in direction, according to the pipe manufacturer's recommendations.
- C. All piping shall be black carbon steel, except in dry systems where pipe shall be galvanized per ASTM A53.

- D. Fittings used to join pipe shall be listed fabricated fittings or manufactured in accordance to the material and dimension standards listed in table 2.2.1 NFPA 14.

2.2 TAMPER SWITCH / SUPERVISORY SWITCH

- A. Tamper switch on each valve
 - 1. Controlling or shutting off standpipe system or any portion thereof.
 - 2. Tamper switch with either one single pole, double throw switch or two single pole, double throw switches as required.
 - 3. Switch shall be compatible with installed valve for standard mounting.
 - 4. Potter-Roemer Fig. 6220, 6221, 6222, 6223 or approved equal.

2.3 FLOW SWITCH

- A. Vane type flow switch.
 - 1. Self-contained, pneumatic, adjustable retard.
 - 2. Two, single pole, double throw switches.
 - 3. Red enamel tamper proof switch housing with flow paddle.
 - 4. Potter Roemer Model No. 6200, or approved equal.

2.4 ROOF MANIFOLD

- A. Provide cast brass manifold of the 3-valve design, 2-1/2 inch x 2-1/2 inch x 2-1/2 inch x 6. Furnish each valve with brass cap and chain. Threads are to match local fire department, manufactured by Potter Roemer.

2.5 FIRE DEPARTMENT VALVES

- A. Provide 2-1/2 inch angle valve, cast or forged brass with 2-1/2 inch coupling with local fire department threads with cap and chain, manufactured by Potter Roemer.

2.6 FLOORS AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas. Size plates to fit pipe or insulation and lock in place.

2.7 DOMESTIC MANUFACTURE

- A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

2.8 GASKETS

- A. Use 1/16-inch thick preformed synthetic rubber bonded.

2.9 COUPLINGS

- A. Use listed rolled grooved mechanical couplings to engage and lock grooved or shouldered pipe ends and to allow for some angular deflection, contraction and expansion. Coupling consists of ductile iron housing, c-shaped composition sealing gasket and steel bolts. Gasket Material for dry pipe systems shall be silicone and listed for dry pipe service.

2.10 VALVES

- A. Use valves suitable for 175 psig WOG.
- B. Valves to be UL listed and FM approved.

- C. Valve Connections:
 - 1. Provide valves suitable to connect adjoining piping as specified for pipe joints. Use full line size valves unless noted otherwise.
 - 2. Screwed ends for pipe sizes 2 inches and smaller.
 - 3. Flanged ends for pipe sizes 2-1/2 inches and larger.
 - 4. Solder or screw to solder adapters for copper tubing.
 - 5. Use grooved body valves with mechanical grooved jointed piping.
- D. Gate Valves:
 - 1. Up to 2 inches, bronze, outside screw and yoke, rising stem, solid wedge, screwed ends, manufactured by: Mueller, or approved equal.
 - 2. Over 2 inches, iron body, bronze trim, outside screw and yoke, rising stem, solid wedge, flanged ends; manufactured by Mueller, or approved equal.
- E. Check Valves:
 - 1. Up to 2 inch, bronze, regrind bronze swing disk, solder or screwed ends; 200 WOG, manufactured by Mueller, or approved equal.
 - 2. Over 2 inch, iron body bronze trim, swing disk, regrind – renew bronze disk and seat, flanged ends; 200 WOG, manufactured by Mueller, Globe Model RCV, or approved equal.
- F. Butterfly Valve: Lug body style, bubble-tight shutoff, cast iron body, ASTM B 148 bronze disk, with integral tamper switch, manufactured by Anvil, Model No. 8000 FP, or approved equal.

2.11 GAUGES

- A. Gauges shall be bourdon tube type with minimum 4-1/2 inch dial and die cast aluminum case with screwed ring and black enamel finish. The movement shall be all stainless steel with Grade A phosphor bronze bourdon tube, brazed at socket and tip. The accuracy of the gauge shall be within one-half of one percent of the scale range. The pointer shall be the micrometer adjustment type recalibrated from the front. Pressure and compound gauges shall have suitable scale ranges and graduations. Suitable for temperatures up to 120 degrees F.
- B. Gauges shall have 1/4 inch connections and be mounted with combination stop / snubber needle valve with suitable pressure rating. Scale ranges: 0-200 psi.
- C. Gauge range shall be such that system normal operating pressure falls with 25 percent and 75 percent of the full-scale range.
- D. Pressure scale graduations shall read in psig. Figure intervals shall be in – 20 psig increments, with minor divisions in 2 psig increments.
- E. The accuracy of the gauge shall be at least 0.5 percent of the scale range. Gauge shall be made in accordance with ASME B40.1 accuracy grade 2A.
- F. Manufactured by:
 - 1. Trerice. Model No. 4500 Series
 - 2. Ashcroft
 - 3. Marsh
 - 4. Weksler

2.12 SIAMESE FIRE DEPARTMENT CONNECTION

- A. Siamese Wall mounted chrome-plated Siamese. Include caps, sillcock, chain, and a plate lettered STANDPIPE.
 - 1. Provide a 4" X 2-1/2" x2-1/2".
 - 2. Potter-Roemer #5751

2.13 FIRE DEPARTMENT VALVES

- A. Fire Department Valve: 2-1/2 inch cast brass valve with red hand wheel, female NPT inlet X male hose thread outlet. UL listed and FM approved 300 psi. Potter Roemer #4065 with Potter Roemer #4625 cap and chain.
- B. Thread Test. Test threads on 2-1/2" valves, using a coupling from the local fire department hose. Make the test in presence of the Engineer.

PART 3 - EXECUTION

3.1 DESIGN

- A. Design of fire standpipe system and selection of sizes shall conform to the requirements of NFPA 14 for the indicated occupancy.
- B. Friction losses in pipe will be based on a value of "C" = 120 in the Hazen and Williams formula.
- C. Design and install the system so that no part will interfere with doors, windows, heating, mechanical, lighting or electrical equipment.

3.2 PREPARATION

- A. Ream pipes and tubes, clean off scale, rust, oxide and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.
- B. Pipe beveled each end, per approved procedures.
- C. Hammer clean and flush out piping after welding to remove scale, welding slag and other debris.

3.3 CONNECTION

- A. Make screwed joints with square, clean full cut standard taper pipe threads. Ream after cutting and threading. Red lead and linseed oil or other approved non-toxic joint compound applied to male threads only.
- B. Nipples: Shoulder type; extra heavy where less than 1-1/2 inch is unthreaded.
- C. Clamp cast iron water pipe at fittings with 3/4 inch rods and properly anchor and support.
- D. Use grooved mechanical couplings and mechanical fasteners only in accessible locations.

3.4 COORDINATION

- A. Coordinate the installation schedule for this work with the construction schedule for the Work to ensure orderly progress with minimum delay.
- B. Coordinate interface of fire standpipe system with the work of other trades to ensure proper and adequate provision for the installation and connection of this system.
- C. Coordinate location and quantity of Siamese connections required for fire department connection with Architect and local fire officials.

3.5 SURFACE CONDITIONS

- A. Before starting each stage of the fire standpipe system installation, inspect the installed work of other trades and determine that work is complete enough to allow installation to begin.

Ensure that work of other trades has been installed in a manner to permit work of this Section in accordance with approved design.

3.6 INSTALLATION

- A. Run piping as high as possible and between parking tee's where possible to minimize obstructions.
- B. Protect standpipes and fire department valves against mechanical injury.
- C. Locate system drains and inspector's test connections at low points and readily accessible areas.
- D. Where low points or drains occur, furnish drain valve with brass cap and chain.
- E. Install pipe markers to identify fire protection piping system.
- F. Install fire 2-1/2 inch department valve, maximum 5 feet above floor, complying with NFPA 14.
- G. Provide drain for each standpipe.
- H. Install valves with stems upright or horizontal, not inverted.
- I. Install the complete fire standpipe system in accordance with the approved shop drawings.
- J. Perform piping installation in accordance with the provisions of the specifications, including furnishing of required sleeves for fire system pipes passing through rated walls, floors, and other parts of the building. Provide scheduled 40 galvanized pipe sleeve for concrete or CMU penetrations. Furnish size required for fireproofing and or insulation. Furnish and install split wall plates and chrome plated escutcheons for exposed fire standpipe system pipes. Where pipes pass through concrete floors, furnish and install wrought iron or steel pipe sleeves made flush with the ceiling below and extending 2" above the finished floor.
- K. Do not cut or make holes in any part of the building except where shown on the approved shop drawings.
- L. During construction, make one standpipe outlet available on each floor without delay, for fire department use.
- M. Provide 3-way standpipe outlets above roof.
- N. Provide pressure gauges at the top of each standpipe as detailed on the drawings.

3.7 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.
- B. Provide supports both sides of elbows for pipe 6" and larger.
- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed.

- D. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Steel Max. Support Spacing, Feet	Minimum Rod Diameter, Inches
1" & smaller	6	3/8
1-1/4" & 1-1/2"	8	3/8
2"	10	3/8
3"	10	1/2
4" & 5"	10	5/8
6" and above	10	3/4

3.8 PIPE SUPPORTS

- A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.
- B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Ring type clevis hangers are not acceptable.

3.9 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:
- Fabricate sleeves of Schedule 40 galvanized steel pipe.
 - Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. Sleeves through gypsum wall construction.
- Fabricate sleeves of 16 gauge galvanized sheet metal.
- C. Sleeves through elevated slab construction.
- Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.
- D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.
- E. Caulk sleeves water and airtight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
- F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
- G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
- H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.10 CLEANING OF PIPING SYSTEMS

- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.

3.11 FLUSHING AND TESTING

- A. Testing of standpipe system shall be in accordance with NFPA-14.
- B. In addition to NFPA-14 required tests, provide tamper switch test for each device and coordinate operation with alarm annunciation.
- C. All tests shall be witnessed by Architect / Engineer. Contractor shall notify Architect / Engineer 7 working days in advance.

3.12 EXCAVATING, TRENCHING, AND BACKFILLING

- A. Perform excavation, trenching, and backfilling for this portion of the work in accordance with the specifications.

3.13 PIPE MARKERS

- A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Minimum size: 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- C. Install identification in the following locations:
 - 1. Both sides of penetrations through walls, floors and ceilings.
 - 2. Close to valves or flanges.
 - 3. Intervals on straight pipe runs not to exceed 50 feet
 - 4. Apply marker where view is obstructed.
- D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 "Scheme for Identification of Piping Systems".

3.14 TESTING AND ACCEPTANCE

- A. Upon completion of the fire standpipe system installation, test and retest the complete installation and make corrections as necessary to obtain acceptance by the Fire Marshall and/or any other authority having jurisdiction. Furnish test equipment and personnel required.

3.15 TRAINING

- A. At a time mutually agreed upon, provide 2 hours of instruction to the Owner's designated personnel on the operation and maintenance of the automatic sprinkler system and associated equipment. Owner's Operation and Maintenance Manual prepared for this project shall be used during the instruction.

END OF SECTION

SECTION 21 31 13

FIRE PUMP SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide and install one packaged fire pump system, including a horizontal split case, centrifugal fire pump complete with motor, controller, and accessories as outlined.

1.2 RELATED WORK

- A. Division 23, Mechanical.

1.3 STANDARDS

- A. Make the installation in accordance with applicable requirements of National Fire Protection Association (NFPA) pamphlets, Factory Mutual, and any requirements of state or local authorities.
- B. Furnish equipment and materials approved by NFPA and UL.

1.4 REQUIREMENTS

- A. The Contractor shall provide and install a packaged fire pump system, designed in accordance with the requirements of NFPA Pamphlet #20. The system manufacturer will assume unit responsibility for the proper operation of the entire packaged system as specified herein.
- B. The Fire Pump manufacturer shall have a quality management system in place and shall be ISO 9001 Certified.

1.5 SHOP DRAWINGS

- A. Make complete shop drawings and working drawings of equipment furnished, including detailed drawings. Submittal data for the pumping system shall include, but is not limited to: pump curves, individual computer data sheets, system drawings, and complete description of control panel with wiring diagram, sequencing data, instrumentation, alarms, and a copy of certification of \$1,000,000.00 minimum liability insurance.
- B. Before the shop drawings are submitted for approval, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the departments.
- C. The Architect's approval of shop drawings shall not relieve the responsibility of correctly figured dimensions or any errors that may be contained in these drawings. The omission of any material shown on the contract drawings, or specified from the shop drawings, even though approved, shall not relieve the responsibility to furnish and erect them.

1.6 FACTORY TEST

- A. All equipment will be factory tested in accordance with the requirements of NFPA, UL and FM. Additionally the entire packaged system will be hydrostatically tested by the system manufacturer prior to shipment.

PART 2 - PRODUCTS

2.1 DESIGN

- A. Pump shall be designed to deliver 1500 gpm when operating against at TDH as shown below. The pump shall also deliver not less than 150% of rated capacity at a pressure not less than 65%

of rated pressure. Minimum suction pressure is 30 psig. Motor and pump speed shall not exceed 1775 rpm. Unit provide under provision NFPA-20, 1993. Unit pressure shut-off head shall not exceed 140% of rated pressure.

DESIGN POINTS	GPM	TDH	% DESIGN TDH
SHUTOFF	0	275 HD	0%
DESIGN	1500	231 HD	100%
150% DESIGN FLOW	2250	155 HD	150%

2.2 PUMP

- A. The pump shall be horizontal, split case, class 40, cast iron, bronze fitted, centrifugal fire pump listed by Underwriters Laboratories and/or approved by Factory Mutual (UL/FM).
1. The unit shall be a Patterson 8" suction x 6" discharge, Model 8X6MI
 2. The unit shall be mounted on a fabricated steel base, complete with coupling, OSHA approved, coupling guard, and directly connected to the motor.
 3. The pump shall be clockwise rotation as viewed from the driver end.
 4. The pump discharge flange shall be rated for 125 lbs
 5. The pump casting shall be smooth, free of scale, lumps, cracks, sand holes and defects of any nature which may make it unfit for the use for which it is intended.
 6. The bolting of pressure-holding castings shall be such that the maximum stress on any bolt will not exceed $\frac{1}{4}$ the elastic limit of the material as computed by using the stress area and on the basis of the water pressure equivalent to the shutoff pressure effective over the area out of the center line of the bolts.
 7. The pump bearings shall have an L-10 rating of not less than 5000 hours based on load ratings and fatigue life.
 8. The shaft shall be sealed with a stuffing box and packing with external water-seal piping. The stuffing box glands shall exert uniform pressure on the packing.
 9. Bearing housing supports, and suction and discharge flanges shall be integrally case with the lower half of the casing. Removal of the upper half of the casing must allow the rotating element to be removed without disconnecting the suction and discharge flanges. Replaceable shaft sleeves shall be furnished and are to be of bronze ASTM-A148 material. The shaft sleeves shall be held in position by the impeller key and locked in position by a separate threaded sleeve nut.
 10. Water slingers of corrosion-resistant material shall be provided to seal the bearings at their inner ends.
 11. The pump casing shall be hydrostatic strength-tested to a minimum of 250 psi, or not less than twice the maximum shut-off pressure.

2.3 DRIVER

- A. The motor shall be 125 HP, 1775 rpm, 3 phase, 60 cycle, 480 volt, horizontal open Dripproof motor with a 1.15 service factor.

2.4 FIRE PUMP CONTROLLER WITH TRANSFER SWITCH

- A. The controller shall be a Hubbell Model LX2100, UL/FM labeled combined manual and automatic type designed for soft start / soft stop.
1. NEMA Type 2 enclosure
 2. The fire pump controller and transfer switch shall be a single factory wired unit meeting the requirements of the most recently mandated edition of NFPA 20 and shall be listed by Underwriter's Laboratories and approved by Factory Mutual Research Corporation. Both shall bear the labels of UL, ULC, CSA, FM and NYB of S and A.
- B. The minimum withstand rating of the controller shall not be less than 100,000 Amps RMS Symmetrical at 480 V.
- C. The controller manufacturer shall provide a five year warranty to include all parts and replacement labor covering the controller power circuit components, including isolating switch, circuit breaker,

current sensing module and motor contractors.

- D. The isolating disconnect switch and circuit breaker shall be mechanically interlocked so that the enclosure door cannot be opened with the handle in the ON position except by a hidden tool operated defeater mechanism.
- E. The controller shall have a minimum running period timer set for 10 minutes. Terminals shall be provided to field convert the controller from automatic to manual shutdown.
- F. The Controller shall have externally mounted individual visible indicators for:
 - 1. Power available
 - 2. Low Pressure
 - 3. Local start
 - 4. Remote start
 - 5. Deluge valve open
 - 6. Phase failure
 - 7. Phase reversal
 - 8. Interlock on
 - 9. Pump running
 - 10. Run timer on
- G. The controller shall be supplied with duplicate, individual Phase Failure, Phase Reversal and Pump Operating alarm contacts.
- H. The power transfer switch shall be designed for use with generator set emergency power source. The power transfer switch shall include a motor rated disconnect / isolating switch capable of interrupting the motor locked rotor current. The disconnect / isolating switch shall be mechanically interlocked so that the enclosure door cannot be opened with the handle in the ON position except by a hidden tool operated defeater mechanism.
- I. The transfer switch circuitry shall be capable of sensing both the normal power source and the emergency source. The normal power source pickup shall be set to pickup at 90% nominal voltage and 95% nominal frequency. All voltage sensing, frequency sensing, and time delays shall be field adjustable. The transfer signal shall be delayed for one second, delaying the transfer and engine start signals so as to override momentary normal power outages.
- J. The transfer switch shall have the following mounted on the flange of the enclosure:
 - 1. Transfer switch normal pilot light
 - 2. Transfer switch emergency pilot light
 - 3. Emergency Isolating switch off pilot light
 - 4. Test switch
 - 5. Transfer bypass switch
 - 6. Audible Alarm pushbutton
 - 7. Silence Alarm pushbutton
- K. The transfer switch shall be electrically operated and mechanically held, and shall be capable of being operated by a manual transfer mechanism located on the switch.

2.5 PUMP ACCESSORIES

- A. ½" automatic air release valve
- B. 4-1/2" suction and discharge gauges
- C. ¾" Casing Relief Valve
- D. 6" x 8" Concentric Discharge Increaser (125 lb)
- E. 8" outside hose valve header (125 lb)

- F. Six 2-1/2" hose valves with caps and chains

2.6 JOCKEY PUMP

- A. The jockey pump controller shall be a Patterson Model FPJP complete with fusible disconnect, Hand-Off-Automatic selector switch and a pressure switch. The controller shall be rated for 2 HP, 3 Phase, 60 Cycle, 460 Volt operation.
- B. The minimum enclosure rating shall be NEMA Type 2, driptight.

PART 3 - EXECUTION

3.1 FACTORY FABRICATION

- A. All of the above equipment will be mounted on an open structural steel I-beam skid. All piping, pressure sensing lines, pump by-pass, shut-off valves, stuffing box and casing relief valve drains will be firmly anchored to the steel base by means of structural steel supports. All electrical wiring between controllers and drivers will be completed and tested at the factory. The entire package will require one power connection by the electrical contractor.

3.2 INSTALLATION

- A. Installation shall be in accordance with manufacturer's instructions.

3.3 FIELD ACCEPTANCE AND START-UP SERVICE

- A. The service of a factory-trained representative shall be made available on the job site to check installation, field acceptance testing, start-up and instruct operating personnel.
- B. In order to ensure the fire pump unit is properly coordinated and will function in accordance with the intent of these specifications, all the equipment required to comprise the fire pump unit will be supplied by the fire pump manufacturer in whom shall be vested unit responsibility for the proper function of the complete fire pump unit including the fire pump, motor or engine, base plate, control equipment and other required accessories.
- C. To verify compliance with this requirement, the fire pump manufacturer will be required to submit a notarized Certificate of Compliance certifying that all components of the fire pump unit were in fact supplied by the fire pump manufacturer and acknowledging its responsibility for the proper function of the unit.

3.4 GUARANTEE

- A. The packaged fire pumping system shall be guaranteed in writing, by the manufacturer for a period of one year from date of shipment against defect in design, material or construction.

END OF SECTION

SECTION 22 05 00

PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 22 Plumbing.
- B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Plumbing work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories
 - 2. National Fire Protection Association
 - 3. State Health Department
 - 4. Local Municipal Building Inspection Department
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than three (3) systems of comparable size and type that has served their Owners satisfactorily for not less than three (3) years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimums for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.
- B. As-Built drawings should indicate the following information as a minimum:
 - 1. Indicate all addendum changes to documents.
 - 2. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
 - 3. Indicate exact location of all underground plumbing and flow line elevation.
 - 4. Indicate exact location of all underground plumbing piping and elevation.
 - 5. Indicate exact location of all underground electrical raceways and elevations.
 - 6. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 - 7. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
 - 8. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
 - 9. Exact location of all electrical equipment in and outside of the building.
 - 10. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
 - 11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 - 12. Cloud all changes.

1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

- A. Guarantee work for one (1) year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 22 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

- A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

1.17 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.

- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.18 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.
- C. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.19 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.20 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

1.21 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

1.22 ELECTRICAL PROVISIONS OF PLUMBING WORK

- A. Electrical provisions to be provided as mechanical work are indicated in other Division 22 sections, on drawings, and as specified.
- B. Types of work normally recognized as electrical but provided as plumbing, specified or partially specified in this Section, include but are not necessarily limited to the following:
 - 1. Motors for plumbing equipment.
 - 2. Starters for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 3. Wiring from motors to disconnect switches or junction boxes for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical-electrical devices provided for plumbing systems, to equipment control panels.

- C. Refer to Division 26 sections for motor starters and controls not furnished integrally with mechanical equipment, junction boxes and disconnect switches required for motors and other electrical units of mechanical equipment.
- D. Verify voltage on electrical plans.

1.23 PRODUCT DATA AND INSTALLATION INSTRUCTION

- A. Submit only pages which are pertinent to the project. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances
- B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- C. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.24 CONTRACTOR SUBMITTAL AND SHOP DRAWING RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
 - 1. Field measurements.
 - 2. Field construction criteria.
 - 3. Manufacturer's catalog numbers.
 - 4. Conformance with requirements of Contract Documents.
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
 - 1. Proper sizes and capacities.
 - 2. That the item will fit in the available space in a manner that will allow proper service.
 - 3. Construction methods, materials and finishes.
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
 - 1. Four-inch high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings.
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Doweled to existing slab.
- D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

- A. Provide a handle for each loose keyed operated valve and hose bibb on the project.
- B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner two (2) suitable tools for use with each type of fastener used.
- C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
 - 1. Provide the training during the Owner's regular working day.
 - 2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.
- B. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- D. Demonstrate equipment functions (both individually and as part of the total integrated system).

3.5 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
 - 1. Designation approved by Architect/Engineer.
 - 2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
 - 3. Submit schedule of equipment to be included and designations.

- B. Provide nameplates with ½-inch high letters and fastened with epoxy or screws.

3.6 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
 - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

3.8 OPERATION AND MAINTENANCE MANUAL

- A. Content of Manual:
 - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number.
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer.
 - 2) Maintenance contractor as appropriate.
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement.
 - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
 - 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - 1) equipment shall be marked out indicated in some manner.

END OF SECTION

SECTION 21 10 00

PLUMBING PIPING AND FIXTURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install plumbing piping in buildings and site. Insulate all hot domestic water piping above grade. All domestic water products including, but not limited to, pipe, fittings, and fixtures shall be 'Lead Free'
- B. Cellular core PVC pipe is not permitted.
- C. Furnish and install water closets, urinals, lavatories, electric drinking fountains, fixture carriers and plumbing appurtenances.

1.2 JOB REQUIREMENTS

- A. Furnish plumbing fixtures and trim as shown and specified. Provide faucets, fittings, supply stops and similar devices of a single manufacturer. Furnish faucets and supply stops with renewable seats. Porcelain to steel and enameled cast iron fixtures shall be acid resistant. Wall hung fixtures shall be installed with a fixture carrier.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING AND FITTINGS

- A. Below Slab on Grade Piping for Water Entries: provide ASTM B88 and ANSI/NSF Standard 61 Type K annealed tempered (soft) seamless copper water tube. No joints below slab entries.
- B. Below Slab on Grade Piping. Furnish ASTM B 88 and ANSI/NSF Standard 61 annealed tempered (soft), Type K copper water tube. Run continuous with no joints under the floor slab. Provide copper pipe corrosion protection as specified in this Section.
- C. Above Slab Piping. Provide seamless ASTM B 88 and ANSI/NSF Standard 61 drawn tempered (hard) Type L copper water tube with wrought copper or bronze fittings with solder-joints, ANSI B16.22. Solder material shall be 95-5 (lead free) (Tin-Antimony-Grade 95TA) ASTM B 32.
- D. Air Chambers. Provide a minimum 18-inch long air chamber, of the same size and connecting pipe material at each single lavatory, sink, drinking fountain or fixture that does not have a quick-closing valve or electrical, pneumatic, spring loaded type, or flush valve. Air chambers to be used for remote fixtures and not mixed with water hammer arrestors at group toilets.
- E. Water Hammer Arrestors. Provide piston type hydraulic engineered/manufactured water hammer arrestors in cold and hot water supply lines in chases or walls to each fixture branch or battery of fixtures serving quick closing valves of electrical, pneumatic, spring loaded type, or quick hand closure valves on fixture trim. Provide water hammer arrestors at the end of the branch line between the last two fixtures served. Provide Precision Plumbing Products, Inc., or equal. Size units according to water hammer arrestor's Standard PDI WH-201; refer to schedule on drawings.
- F. Insulation. 3/4" Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips.
- G. PEX system must be listed ASTM F876/F877. Tubing shall be listed PEX 5006 for chlorine

resistance for continuous usage up to 140°F. All tubing installed in return air plenums shall be listed ASTM E84. The listing may be for the tubing itself or for the tubing including insulation to achieve the listing. The fittings shall be of the same manufacturer as the tubing and the installation instructions of the manufacturer shall be strictly adhered to. Viega PureFlow or Uponor Systems only.

- H. Flow-Splitter Valves. Multi-looped system for providing constant hot water circulation through looped piping to public lavatories and plumbing fixtures. Maintaining domestic hot water loop temperatures and minimize non-circulating lengths to within IECC standards. Lead-free, corrosion resistant red brass dual tee assembly valve with internal, self-adjusting flow regulator including factory loop line ¼ turn shut off valves and factory insulation jacket. NSF 61/372 certified. Configured with female NPT thread connections and 1/4 turn full bore stop valves on loop line connections. Venturi Flow-Splitter Series 651.

2.2 SANITARY SEWER PIPE AND FITTINGS

- A. Above Slab Piping: Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82 and NSF 14.
- B. Below Slab on Grade Piping: Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82 and NSF 14.
- C. Below Slab on Grade Pipe for Grease Waste:
 - 1. Epoxy Coated service weight cast iron hub and spigot pipe and fittings.
 - 2. Compression type, with neoprene gaskets shall conform to ASTM C-564.
 - 3. Pipe shall conform to requirements of ASTM A74.
 - 4. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
- D. Above Slab Pipe for Grease Waste:
 - 1. Epoxy Coated No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.
 - 2. Pipe shall conform to ASTM A74.
 - 3. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
 - 4. No-Hub couplings shall be per 22 13 16, 2.1, A & B.

2.3 SANITARY VENT PIPE AND FITTINGS

- A. Above Slab Piping in Walls: Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82 and NSF 14.
- B. Below Slab on Grade Piping: Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82 and NSF 14.

2.4 CONCEALED STORM DRAIN PIPING

- A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing. Install insulation of clean, dry piping.
- B. Insulation shall be wrapped tightly on the piping with all circumferential joints and longitudinal joints overlapped a minimum of 2" with facing to the outside to obtain specified R-value using a maximum of 25% compression.
- C. Provide vapor retarder at penetrations, joints, seams and damage to the facing with staples and FSK foil tape. The facing shall be taped with a minimum 3" wide strip of reinforced foil tape. Pressure-sensitive tape shall be a minimum 3" (76mm) wide and shall be applied with moving pressure using an appropriate sealing tool. Staples shall be outward cinch and placed 6" (152mm) on center.

2.5 D. Mechanical / Electrical rooms and above ceilings are considered concealed spaces.
ACCEPTABLE FIXTURE MANUFACTURERS

- A. Plumbing Fixtures:
 - 1. American Standard.
 - 2. Kohler.
 - 3. Toto
 - 4. Zurn
 - 5. Sloan
 - 6. Bradley (Solid Surface)
 - 7. Willoughby (Solid Surface)
 - 8. Acorn Corterra Series
- B. Plumbing Faucets:
 - 1. American Standard.
 - 2. Chicago.
 - 3. T&S Brass.
 - 4. Zurn.
 - 5. Symmons.
 - 6. Speakman
 - 7. Moen Commercial
 - 8. Delta Commercial
- C. Supports and Carriers:
 - 1. Zurn.
 - 2. J.R. Smith.
 - 3. Wade.
 - 4. Josam.
 - 5. Watts
 - 6. MIFAB
- D. Flush Valves:
 - 1. Sloan
 - 2. Zurn
 - 3. Moen Commercial
- E. Supplies, Stops and Chrome Plated Tubular Brass:
 - 1. McGuire
 - 2. Kohler
 - 3. Chicago
 - 4. Zurn
- F. Water Closet Seats:
 - 1. Beneke
 - 2. Church
 - 3. Olsonite
 - 4. Bemis
 - 5. Centoco
- G. Electric Drinking Fountains:
 - 1. Halsey Taylor
 - 2. Elkay
 - 3. Oasis
 - 4. Haws
 - 5. Acorn Aqua
- H. Floor Drains:
 - 1. Zurn

2. J.R. Smith
 3. Josam
 4. Wade
 5. Watts
 6. Sioux Chief
 7. MIFAB
- I. Cleanouts:
1. Zurn
 2. J.R. Smith
 3. Josam
 4. Wade
 5. Watts
 6. MIFAB
- J. Stainless Steel Sinks:
1. Elkay
 2. Just
 3. Griffin
 4. Moen Commercial
 5. Amtekco Industries
- K. Mop Sinks:
1. Crane Fiat
 2. Stern Williams
 3. Acorn
 4. CECO
- L. Thermostatic Mixing Valves
1. Lawler
 2. Symmons
 3. Leonard
 4. Powers
 5. Holby
 6. Bradley
 7. Acorn
- M. Shock Arrestors:
1. Precision Products
 2. Sioux Chief
 3. MIFAB
- N. Backflow Preventors
1. Watts
 2. Febco
 3. Wilkins
- O. Hose Bibbs
1. Chicago
 2. Josam
 3. Woodford
 4. Zurn
 5. J.R. Smith
 6. Wade
 7. MIFAB
- P. Wall Hydrants
1. Woodford
 2. MIFAB

3. Zurn
4. J.R. Smith
5. Josam
6. Wade

- J. Shower Systems:
1. Bradley
 2. Acorn
 3. Willoughby

- K. Shower Valves
1. Chicago
 2. Acorn
 3. Symmons
 4. Bradley
 5. Moen Commercial

- L. Roof Drains:
1. Wade
 2. J.R. Smith
 3. Josam
 4. Zurn
 5. Watts

PART 3 – EXECUTION

3.1 SANITARY INSTALLATION

- A. Give horizontal pipe grade of 1/4-inch per foot where possible, but not less than 1/8 inch per foot unless otherwise shown.
- A. Above ground installation in the horizontal position shall be supported at every hub. Hangers to be placed within 18" of hub or coupling. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15'-0".
- B. All above and below slab PVC sanitary waste and vent piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer's recommendations and applicable standards.
- C. All PVC underground shall be installed in accordance with ASTM D2321.
- D. Offsets and Fittings.
 1. Use reduction fittings to connect two pipes of different diameter.
 2. Change directions by appropriate use of 45-degree wyes, long-sweep quarter-bends, and sixth-, eighth-, and sixteenth-bends. Sanitary tees can be used on vertical stacks. Use long sweeps at the base of risers.
 3. Provide a separate trap at each fixture, unless a trap is built into the fixture. Provide a deep seal trap at each floor drain and hub drain. Place traps so that the discharge from any fixture will pass through only one trap before reaching a building drain.
- E. Hub Drains. Install hub drains where indicated, with the top of the hub 1/2 above the finished floor, unless otherwise indicated on the drawings.
- F. Cleanouts. Install cleanouts the same size as the soil waste lines in which the cleanouts are placed; however, no cleanout should be larger than 4 inches in diameter.
 1. Where cleanouts occur in pipe chases, bring the cleanouts through the walls and install covers. Where cleanouts occur in floor slabs, set flush. Reference drawing schedule.

2. Provide cleanouts where soil lines change direction, every 50 foot on long runs, or as shown on the drawings, at the end of each horizontal waste line, and at the base of each riser (and at each increase in pipe size).
 3. Cleanouts shall occur at the end of each battery of water closets, urinals, lavatories, sinks, and single water closets. Cleanouts shall be installed so as to access the main sanitary or soil line. Extend and offset above flood rim of fixture.
 4. Double sanitary tees and double quarter bends do not allow for easy access to main lines, therefore these types of fittings are not allowed.
- G. Floor Drains. Locate floor drains 1/2-inch below finish floor elevation unless otherwise shown.
- H. Make vent connections to vent stacks with inverted wye fittings. Extend full-size vents through the roof to at least 6 inches above the roof.
- I. Flash the roof penetration with not less than 3 pounds per sq. ft. or 1.2 mm thick lead flashing approximately 24 inches square. Flange the flashing to the lead sleeve. Extend the flashing up and around the vent pipe. Turn the flashing down inside the pipe at least 2 inches to make a watertight joint. Flashing shall comply with the roofing manufacturer's requirements. Reference the Architectural Drawings for exact requirements.
- J. Locate vent piping through roof a minimum horizontal distance of not less than 20 feet from any air intake opening or supply fan

3.2 DOMESTIC WATER PIPE INSTALLATION

- A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufacturer, for maintenance.
- B. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.
- C. Install water piping systems with uniform horizontal grade of 1/8 inch per 10 foot, minimum, to low points to provide complete system drainage. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to new level. Grade branches to drain to mains or risers. Unless otherwise indicated, terminate low points of risers with drain valve piped to nearest hub or floor drain.
- D. Cover all domestic hot water piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3" wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with vapor barrier coating for chilled water piping applications.
- E. Flow-Splitter Valves. Install potable water loop circulation system with Flow-Splitter in accordance with construction drawings and factory recommendations. Valve to be installed according to flow direction indicator. Circulation loop piping from primary hot water source at the Flow-Splitter shall be run to connection points of angle stops serving fixtures and to tub or shower points of connection returning to the Flow-Splitter/hot water source piping. Non-circulation portions of piping shall be no more than 24 inches in length.

3.3 UNDERGROUND WATER PIPING SYSTEM PROCEDURES

- A. Lay sewer and water lines in separate trenches, separated by 10 foot of undisturbed or

compacted soil.

3.4 SANITARY SEWER TESTING

- A. Below Slab on Grade and All Floors in Multi-Story Buildings:
 - 1. Test pipe below slab on grade before backfilling and connecting to city sewers.
 - 2. Maintain not less than 10 foot of hydrostatic head for 1 hour without a leak.
 - 3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.
 - 4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
 - 5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
 - 6. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.

3.5 DOMESTIC WATER TESTING

- A. Test under a cold water hydrostatic pressure per the State Plumbing Code and carefully check for leaks. Repair leaks and retest system until proven watertight and maintained for 6 hours.
- B. Use only potable water for the test.
- C. Perform the test before fixtures, faucets, trim or final connections are made to equipment.
- D. If the system is tested in sections, the entire domestic water piping system shall be submitted to a final test, employing the specified procedure.
- E. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- F. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
- G. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.6 COPPER PIPE CORROSION PROTECTION

- A. Provide plasti-sleeve 0.006 thick corrosion protection on the copper tube piping systems in the building slab, beneath the building slab, and/or buried. Route plasti-sleeve the entire length of below slab on grade copper tubing.
- B. Extend the corrosion protection 6 inches above concrete slab on grade.

3.7 PLUMBING FIXTURE INSTALLATION

- A. Installation shall be in accordance with the manufacturer's instructions.
- B. Make rough-in and final connection of service to each fixture provided under this Section and other Sections or Architectural or Plumbing Drawings.
- C. Provide necessary stops, valves, traps, unions, vents, cold water, hot water, sanitary, etc. for a complete installation.

- D. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibs, and where shown on drawings.
- E. Remove piping and services roughed-in incorrectly and install correctly, without cost.
- F. Exposed piping, fittings and appurtenances shall be chrome-plated brass.
- G. Coordinate with the Contractor for locations and service required for each plumbing fixture.
- H. All floor drains and floor sinks shall have trap primer connections. Provide trap primer valves and 1/2-inch water line to each floor drain connection. Trap primer supply line shall have ball valve and Y strainer on inlet side of trap primer valve to facilitate cleaning.
- I. All floor drains and floor sink locations are to be coordinated with all equipment. Locate drains in mechanical equipment spaces to conform to drain locations of equipment furnished. Coordinate drain location with food service equipment and Architectural Drawings.

3.8 STERILIZATION

- A. Sterilize the water system with solution containing not less than 50PPM available chlorine. Allow chlorinating solution to remain in system for period of 8 hours (minimum). Have valves and faucets opened and closed several times during the period. After sterilization, flush the solution from the system with clean water until residual chlorine content is less than 0.2 parts per million.

END OF SECTION

SECTION 22 11 23

DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. General characteristics for pumps specified in Division 22 - Plumbing.

1.2 PUMP SELECTION

- A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions.
- B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.
- C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.
- D. The pump curve shall rise continuously from maximum flow to cut-off.

1.3 PUMP SIZE AND TYPE

- A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.
- B. Submit copies of manufacturer's performance curves, as shop drawings on each pump. Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

1.4 CERTIFIED DATA

- A. Submit factory certified pump curves showing pump performance characteristics with pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. Show pump curves with system curve plotted.

PART 2 - PRODUCTS

2.1 DOMESTIC HOT WATER CIRCULATING PUMPS (SMALL) FRACTIONAL HORSEPOWER

- A. Pump Construction:
 1. Wet-rotor, in-line, single stage
 2. Bronze housings with ½" and ¾" sweat connections
 3. Stainless steel housing with union threaded connections
 4. Integrated check valve inside union fitting on a sweat pump housing
 5. Built-in 5-foot, 115 volt AC line cord with NEMA 3 Prong male plug or line cord
 6. Built-in timer
 7. Aquastat thermostatic control

2.2 SUBMERSIBLE SUMP PUMPS AND SEWAGE EJECTORS

- A. Pump Construction:
 - 1. Hermetically sealed motor
 - 2. Positive action air operated diaphragm switch
 - a. High water alarm contact
 - 3. Housing and base cast iron construction
- B. Provide an alarm terminal cabinet.
 - 1. In the event of a high water alarm, energize a pulsing 2" diameter red signal light with graphic "sump pump high water alarm".
- C. Test the sump pump package by operation of the completed system through four cycles of operation.
 - 1. Fill the sump to operational levels
 - 2. Visually check level controls
 - 3. Pump operation
 - 4. Verify absence of piping leaks, sump leaks, excessive noise, and excessive vibration
 - 5. Verify alarms
 - 6. Verify pump capacity
- D. Sump pump package capacity shall be as scheduled.
- E. Acceptable Manufacturers:
 - 1. Hydromatic
 - 2. Little Giant Pump Co.
 - 3. Weil
 - 4. Goulds
 - 5. Grundfos
 - 6. Crane (Barnes) Air Pumps
 - 7. Ebara

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the pumps in accordance with Manufacturer's "Installation, Start-up and Service Instructions".
 - 1. Provide access space around pumps for service.
 - 2. Lubricate pumps prior to start-up.
 - 3. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60" above finished floor. Install line size Ernst bronze rotating wheel, flow indicator with double window, downstream of circulator.
- B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge.
- C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.
- D. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

END OF SECTION

SECTION 22 11 25

DOMESTIC WATER BOOSTER PUMP (In-Line Vertical Multi-Stage w/VFD)

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. Variable Speed Packaged Pumping System with VFDs.

1.2 REFERENCE STANDARDS

- A. The work in this section is subject to the requirements of applicable portions of the following standards:
 - 1. ANSI – American National Standards institute
 - 2. ASTM – American Society for Testing and Materials
 - 3. IEEE – Institute of Electrical and Electronics Engineers
 - 4. NEMA – National Electrical Manufacturers Association
 - 5. NEC – National Electrical Code
 - 6. ISO – International Standards Organization
 - 7. UL – Underwriters Laboratories

1.3 SUBMITTALS

- A. Submit shop drawing and product as specified.
- B. Submit manufacturer's certified capacity data.
- C. Submit manufacturer's installation, start-up and service instructions.
 - 1. Electrical Interlocks
- D. Submit wiring diagram.

1.4 SHIPPING, HANDLING AND STORAGE

- A. Deliver, store, protect, and handle in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals. All equipment and accessories shall be suitably boxed, crated, covered and protected internally and externally to prevent shipping damage and damage from the weather.
- B. Inspect and report concealed damage to carrier within specified time.
- C. Store in a clean, dry space. Maintain factory protection or cover to keep out dirt, water, construction debris, and traffic (heat enclosures to prevent condensation).

PART 2 – PRODUCTS

2.1 VARIABLE SPEED PACKAGED PUMPING SYSTEM WITH INTEGRATED VARIABLE FREQUENCY DRIVE MOTORS

- A. Furnish and install a prefabricated and tested variable speed packaged pumping system to maintain constant water delivery pressure.
- B. The packaged pump system shall be a standard product of a single pump manufacturer. The entire pump system including pumps and pump logic controller shall be designed and built by the same manufacturer.

- C. The complete packaged water booster pump system shall be certified and listed by UL (Category QCZJ – Packaged Pumping Systems) for conformance to U.S. and Canadian Standards.

2.2 PUMPS

- A. All pumps shall be ANSI/NSF 61 approved for drinking water.
- B. The pumps shall be of the in-line vertical multi-stage design.
- C. The head capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.

- D. Large in-line vertical multi-stage pumps (Nominal flows from 130 to 500 gallons per minute) shall have the following features:

1. The pump impellers shall be secured directly to the smooth pump shaft by means of a split cone and nut design.

2. The suction / discharge base shall have ANSI Class 125 or Class 250 flange connections in a slip ring (rotating flange) design as indicated in the drawings or pump schedule.

3. Pump Construction:

Suction/discharge base, pump head	Ductile Iron (ASTM 65-45-12)
Shaft couplings, flange rings	Ductile Iron (ASTM 65-45-12)
Shaft	431 Stainless Steel
Motor Stool	Cast Iron (ASTM Class 30)
Impellers, diffuser chambers, outer sleeve:	304 Stainless Steel
Impeller wear rings	304 Stainless Steel
Intermediate Bearing Journals	Tungsten Carbide
Intermediate Chamber Bearings	Leadless Tin Bronze
Chamber Bushings	Graphite Filled PTFE
O-rings	EPDM

4. The shaft seal shall be a single balanced metal bellows cartridge with the following construction:

Bellows	904L Stainless Steel
Shaft Sleeve, Gland Plate, Drive Collar	316 Stainless Steel
Stationary Ring	Carbon
Rotating Ring	Tungsten Carbide
O-Rings	EPDM

5. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, motor couplings, motor and seal cover. The entire cartridge shaft seal shall be removable as a one-piece component. Pumps with motors equal to or larger than 15 HP (fifteen horsepower) shall have adequate space within the motor stool so that shaft seal replacement is possible without motor removal.

2.3 INTEGRATED VARIABLE FREQUENCY DRIVE MOTORS

- A. Each motor shall be of the integrated Variable Frequency Drive design consisting of a motor and a variable frequency drive (VFD) built and tested as one unit by the same manufacturer.
- B. The VFD shall be of the PWM (Pulse Width Modulation) design using current IGBT (Insulated Gate Bipolar Transistor) technology.
- C. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of motor. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired

motor magnetization current suitable for centrifugal pump control and to eliminate the need for motor de-rating.

- D. The VFD shall utilize an energy optimization algorithm to minimize energy consumption. The output voltage

PART 3 - EXECUTION

3.1 FACTORY FABRICATION

- A. All of the above equipment will be mounted on an open structural steel I-beam skid. All piping, pressure sensing lines, pump by-pass, shut-off valves, stuffing box and casing relief valve drains will be firmly anchored to the steel base by means of structural steel supports. All electrical wiring between controllers and drivers will be completed and tested at the factory. The entire package will require one power connection by the electrical contractor.

3.2 INSTALLATION

- A. Installation shall be in accordance with manufacturer's instructions.

3.3 FIELD ACCEPTANCE AND START-UP SERVICE

- A. The service of a factory-trained representative shall be made available on the job site to check installation, field acceptance testing, start-up and instruct operating personnel.
- B. In order to ensure the pump unit is properly coordinated and will function in accordance with the intent of these specifications, all the equipment required to comprise the pump unit will be supplied by the pump manufacturer in whom shall be vested unit responsibility for the proper function of the complete pump unit including the pump, motor or engine, base plate, control equipment and other required accessories.
- C. To verify compliance with this requirement, the pump manufacturer will be required to submit a notarized Certificate of Compliance certifying that all components of the pump unit were in fact supplied by the pump manufacturer and acknowledging its responsibility for the proper function of the unit.

3.4 GUARANTEE

- A. The pumping system shall be guaranteed in writing, by the manufacturer for a period of one year from date of shipment against defect in design, material or construction.

END OF SECTION

SECTION 22 14 13

ROOF DRAINAGE PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install roof drains, drain pipes and accessories.

1.1 REFERENCES

- A. CISPI – Cast Iron Soil Pipe Institute
- B. ASTM – American Society for Testing and Materials

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Cast Iron Soil Pipe and Fittings
 - 1. AB&I
 - 2. Charlotte Pipe and Foundry Co.
 - 3. Tyler Pipe / Soil Division

2.2 STORM PIPE AND FITTINGS

- A. Above Ground Piping. Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82.
- B. Below Slab on Grade: Provide hot-dip coated service weight cast iron Hub and Spigot soil pipe and fittings with compression type neoprene gaskets. Pipe and fittings shall meet the requirements of ASTM A 74, and gaskets shall conform to ASTM C-564. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
- C. Provide Fernco "Pro-Flex" shielded couplings, Series 3000 with one-piece neoprene gasket for cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 2" through 8" use Series 3000.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All above and below slab storm piping installation methods shall be in accordance with the Cast Iron Soil Pipe Institute Standards.
- B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers to be placed within 18" of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15'-0".
- C. All above and below slab PVC storm piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer's recommendations and applicable standards, and in accordance with ASTM D2321.

3.2 GRADE

- A. Give horizontal lines minimum grade of 1/8 inch per foot.

3.3 TESTING

- A. Below Floors.
 - 1. Test pipe below floors before backfilling and connecting to sewers.
 - 2. Maintain not less than 10 foot of hydrostatic head for 1 hour without a leak.
- B. System Test. After all the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system:
 - 1. Plugging outlets.
 - 2. Fill vertical sections with water. Provide wyes as required to facilitate plugging.
 - 3. Test for 6 hours without any drop in the water level.

3.4 RODDING SEWERS

- A. All storm sewer lines, both in the building and out, shall be rodded out and flushed out after completion of construction and prior to finish floor being installed. All work must be completed prior to substantial completion. All floor drains and cleanout locations must be included in this work.
- B. All storm lines below building 3" and larger shall be internally video-taped at time of substantial completion. An Owner's Representative shall be present during video-taping. Three copies of the video-tape shall be delivered to the Owner for future records.
- C. This work shall be done in the presence of the Owner's Representative, as part of the Contract, to ensure all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall be full size of pipe being cleaned for pipe sizes up to 6 inches. Pipe sizes 8 inches and larger shall be hydro-flushed.

END OF SECTION

SECTION 22 33 13

INSTANTANEOUS ELECTRIC WATER HEATER

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electric water heaters for domestic water systems.

1.2 RELATED WORK

- A. Division 22 Plumbing
 - 1. Domestic Water Piping.
 - 2. Plumbing Piping Insulation.
 - 3. Division 26 Electrical.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Chronomite
- B. EEMAX

2.2 PRODUCTS

- A. Provide tankless, flow switch activated heater.
- B. Hot water temperature range of 103°F to 120°F.
- C. 0.5 GPM flow rate.
- D. Low pressure model if required. Contractor shall verify pressure at site.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install where shown on Drawings and in accordance with manufacturer's requirements.

3.2 WARRANTY

- A. Provide standard manufacturer's 1 year commercial warranty for mechanical and electrical and 5 year warranty for leaks. Warranty shall start the date of the substantial completion certificate.

END OF SECTION

SECTION 22 33 30

ELECTRIC WATER HEATER

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electric water heaters for domestic water systems.

1.2 RELATED WORK

- A. Division 15 Mechanical:
 - 1. Domestic Water Piping.
 - 2. Mechanical Piping Insulation.
 - 3. Division 16 Electrical.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Lochinvar
- B. State.
- C. Rheem/Ruud
- D. A. O. Smith

2.2 PRODUCTS

- A. Provide electric water heaters with kilowatt, recovery ratings, and storage capacities as scheduled on drawings.
- B. Provide a tank designed for 150 psig working pressure. Furnish glass-lined tank. Lining shall be corrosion-resistant.
- C. Furnish factory-assembled, integral units equipped as follows:
 - 1. Dip tube.
 - 2. Individually mounted thermostat at each element with a high temperature cutoff.
 - 3. Glass lined tank.
 - 4. Minimum R-16 insulation.
 - 5. UL rated.
 - 6. Heavy-duty, tank mounted, screw-in anode rod.
- D. Provide low watt density elements having zinc-plated, copper sheathing and prewired leads.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide at each heater an automatic temperature and pressure relief valve with rating matching or exceeding the energy input rate.
- B. Pipe the discharge port to a point of visible and safe disposal required by codes and the drawings.
- C. Contractor shall provide a temperature gauge at heater.
- D. Install water heater in galvanized drain pan piped to floor drain or exterior. Provide ¾" outlet

connection.

END OF SECTION

SECTION 22 63 11

GAS PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install steel gas pipe inside buildings, including the supply line from the meter, service lines to gas equipment and appliances, termination of the service line with a plug valve, drip leg, and final connection to equipment and appliances with unions.
- B. Coordinate service line from utility main and extend to meter. Coordinate installation of the service line and meter with Gas Company.
- C. Extend steel gas piping from meter to inside the building to all fixtures, appliances and equipment requiring gas.

1.2 RELATED WORK

- A. Division 22 Plumbing
 - 1. Plumbing Pipe and Fittings
 - 2. Valves and Vents

1.3 UTILITY CONNECTIONS

- A. Make arrangements for and pay all fees and connection charges for obtaining service to the building.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS - ABOVE GRADE

- A. Pipe 2 inch and Smaller:
 - 1. Schedule 40 ASTM A 53 black steel pipe
 - 2. Factory fabricated socket weld fittings.
 - 3. Where approved for a specific project and where accepted by local code, cold press mechanical joint fittings shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria of ANSI/CSA LC4. Sealing elements shall be HNBR and the fittings shall bear the CSA stamp to confirm acceptability for fuel gas systems. MegaPress system manufactured by VIEGA including "Smart Connect" to assure unpressed fittings will not hold pressure. Installers shall carry training credentials from the manufacturer to confirm they have been instructed in the correct installation procedures.
- B. Pipe Larger than 2 inch:
 - 1. Schedule 40 ASTM A 53 black steel pipe.
 - 2. Factory fabricated butt weld fittings for welded steel pipes shall conform to ASTM A-234 WPB (seamless weld fittings).
- C. Unions:
 - 1. Standard 150 lb. (300 lb. water, oil or gas) malleable iron.
 - 2. Ground joint unions, with bronze seat.
 - 3. Flange joints for pipe larger than 2 inch in diameter.
- D. Flanges:
 - 1. Steel flanges. ANSI B16.5 and ASTM A-105.

2.2 PIPE AND FITTINGS - BELOW GRADE OUTSIDE BUILDING

- A. Polyethylene pipe shall be ASTM D3350 Grade PE24 cell classification and ASTM D1248 Class B material classification.
- B. Pipe shall be medium density polyethylene PE 2406 and PE 2708 manufactured by Poly Pipe Industries, Inc. or Performance Pipe.
- C. Polyethylene yellow molded butt fittings for use with medium density polyethylene pipe shall meet testing requirements of ASTM D2513 and resin material listing of ASTM D3350 with PPI designation of PE 2406 as manufactured by Central Plastics Co.

2.3 VALVES

- A. See Section 22 05 23.

2.4 GAS PRESSURE REGULATOR

- A. Size the gas pressure regulator in accordance with the manufacturer's recommendations for flow quantities and reduced pressure as required for all equipment. Coordinate final equipment gas pressure requirements prior to ordering regulators. Provide American Meter Company regulators or approved equal, suitable for outdoor installation. Regulators outside exposed to weather shall be installed with vent in vertical down position.
- B. All line pressure regulators shall be listed in accordance with ANSI (American National Standard) Z21.80 and CSA (Canadian Standards Association Standard) 6.22.
- C. Where a line pressure regulator has an inlet pressure over 2 psi and serves an appliance rated for ½ psi (14" of water column) or less, a downstream overpressure device (OPD must be installed in accordance with ANZI Z21.80.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation Standards: Install gas piping in accordance with recommendations of the National Fire Protection Association.
- B. Drip Legs: Install a capped drip leg 6 inches long at the base of each vertical rise.
- C. Coating and Wrapping. Coat and wrap underground piping in accordance with the service utility company standards.
- D. Sleeves.
 - 1. Encase gas piping running in or through solid partitions with thin wall metal conduit. Sleeve piping and fittings shall be two pipe sizes, but not less than 1 inch larger than encased gas piping.
 - 2. Encase gas piping running below slab in Schedule 40 PVC, minimum size two pipe sizes larger than gas pipe. Vent sleeve to atmosphere with a 1-1/2 inch vent with 1-1/2 inch return bend above building roof. Seal ends of sleeve with UL fire rated caulk.
- E. Do not install gas piping exposed to view inside public area, or occupied spaces, without prior written approval.
- F. Weld all gas piping above grade.

- G. Provide test ports and isolation valves to enable proper testing of system in the future.
- H. Provide isolation valve and unions across regulators for proper removal.
- I. Provide transition risers where below grade polyethylene pipe changes to steel pipe above grade.
- J. Gas Pressure Regulators / Vents:
 - 1. Piping shall be sized in accordance with the regulator manufacturer's instructions. Never use pipe sizes smaller than the vent size; smaller pipe sizes restrict the gas flow. Where there is more than one regulator at a location, each regulator shall have a separate vent to the roof / outdoors. Headers with various installed devices can cause regulator malfunction.
 - 2. Support the vent pipe to eliminate strain on the regulator diaphragm case.
 - 3. Install vent piping from regulators to location to prevent gas smells from entering building. Do not locate the vent line terminus near windows, fans, or other ventilation equipment. See the installation instructions furnished with the regulator.
 - 4. Install double elbows and insect screen at end of piping to prevent moisture and insects from entering. Always point outdoor vent pipes in the downward position to reduce the possibility of rain, snow, sleet, and other moisture entering the pipe.
 - 5. When installed inside building route vents horizontally and terminate through building sidewall. The vent must be piped to the outside atmosphere using the shortest length of pipe, the fewest possible pipe elbows, and a pipe diameter as large as the vent size or larger. If a long gas run must be used, increase the pipe one nominal size every ten feet to keep the flow restriction as low as possible. Vents terminating through roof must have prior approval from Architect before installation. Through roof penetrations shall be minimized.
 - 6. Regulators installed outside or on roof top: Install regulator vent turned downward with insect screen over vent opening. The vent shall be designed to prevent the entry of water, insects, or other foreign materials that could cause blockage.
 - 7. Ensure the end of the vent line is away from ANY potential ignition sources. It is the installer's responsibility to ensure the vent line is exhausting to a safe environment
 - 8. Adhere to all applicable codes and regulations.
 - 9. All over pressure protection devices (OPD) shall be vented to the exterior.

3.2 TESTING GAS PIPING

- A. Preliminary gas test as required by code and local AHJ.
- B. Test joints with a soap solution while lines are under pressure.
- C. Repair leaks.
- D. Final gas test shall be with a 24 inch column of mercury or a diaphragm gauge with a minimum dial size of 3-1/2 inches with a set hand and a pressure range not to exceed twenty (20) psig with 2/10-pound increments. The minimum test pressure shall not be less than ten (10) psi and the maximum test pressure shall not exceed twelve (12) psig. This test will be observed for no less than (30) thirty minutes with no drop in pressure.
- E. Provide copy of gas pressure test reports in Operations & Maintenance Manual.

3.3 IDENTIFICATION CONDUCTOR

- A. Spiral A #12 AWG insulated copper conductor the full length of the thermoplastic piping system. Fasten to the pipe at 3 foot intervals with plastic tie wraps.

- B. Terminate at each end in a 12 inch x 12 inch x 4 inch FRP junction box.
 - 1. Bolted gasketed cover with stainless steel screws.
 - 2. Screw type terminal strip.
 - 3. Legend on cover "gas pipe identification conductor."

- C. Set in concrete pad.

3.4 UNDERGROUND STEEL PIPE

- A. Reference Specification Section 22 20 02, Underground Steel Pipe Corrosion Protection.

3.5 PAINT EXPOSED OUTSIDE GAS PIPE

- A. Interior and Exterior Gas piping shall be protected from rust.
- B. Paint pipe with a flat alkyd coating, clean pipe prior to painting by preparing surface by hand tool cleaning per SSPC-SP2-82, applying one coat of Glidden Y-590 Rustmaster Metal Primer White and top coat of Yellow Alkyd Flat Enamel.

END OF SECTION

SECTION 23 05 00

MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 23 Mechanical.
- B. Applicable provisions of this section apply to all sections of Division 23, Mechanical.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Mechanical work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories
 - 2. National Fire Protection Association
 - 3. State Health Department
 - 4. Local Municipal Building Inspection Department
 - 5. Americans with Disabilities Act Standards
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations and sizes of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.
- B. At the conclusion of the project, obtain without cost to the Owner, copies of the original drawings and transfer as-built changes to these. Provide a hard copy of this As-Built Set for the owner's records. The As-Built Set must include all drawings, regardless of whether corrections were necessary. Digital copies of the As-Built Set shall be provided to the architect and engineer. Digital drawings shall be in PDF format. The delivery of the As-Built Set is a condition of final acceptance.
- C. Drawings in the As-Built Set should indicate the following information as a minimum:
 - 1. Indicate all addendum changes to documents.
 - 2. Remove Engineer's seal, name, address and logo from drawings.
 - 3. Mark documents RECORD DRAWINGS.
 - 4. Clearly indicate: DOCUMENT PRODUCED BY
 - 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
 - 6. Indicate exact location of all underground mechanical piping and elevation.
 - 7. Indicate exact location of all underground electrical raceways and elevations.
 - 8. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 - 9. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and mechanical valves.
 - 10. Exact location of all electrical equipment in and outside of the building.
 - 11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 - 12. Cloud all changes.

1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

- A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 23 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

- A. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 AIR FILTERS AND PIPE STRAINERS

- A. Immediately prior to substantial completion of the project, inspect, clean and service air filters and strainers. Replace air filters.

3.3 LUBRICATION, REFRIGERANT AND OIL

- A. Provide a complete charge of correct lubricant for each item of equipment requiring lubrication.
- B. Provide a complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to ensure completely balanced conditions, check the charge and modify for proper operation as required.
- C. Provide a complete charge of special oil for refrigeration use, suitable for operation with refrigerant, in each system.

3.4 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted HVAC equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
 - 1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Doweled to building slab
- D. Install concrete curbs around duct penetrations or multiple pipe penetrations.

3.5 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the mechanical systems.
 - 1. Provide the training during the Owner's regular working day.
 - 2. The Instructors shall each be experienced in their phase of operation and maintenance of building mechanical systems and with the project.
- B. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
 - 1. One copy to the Owner.
 - 2. One copy to the Architect/Engineer.
- C. The Owner will provide a list of personnel to receive instructions and will coordinate their attendance at the agreed upon times.
- D. Use the operation and maintenance manuals as the basis of instruction. Review contents of

manual with personnel in detail to explain all aspects of operation and maintenance.

- E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- F. Demonstrate equipment functions (both individually and as part of the total integrated system).
- G. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- H. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.
- I. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- J. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.6 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
 - 1. Designation approved by Architect/Engineer.
 - 2. Equipment includes, but is not limited to, air handling units, fan coil units, variable volume boxes, fans, pumps, boilers and chillers.
 - 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.7 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
 - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.8 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

3.9 INDOOR AIR QUALITY

- A. All equipment and ductwork shall be installed to allow sufficient space for testing, maintenance, and commissioning functions. Access doors or panels shall be installed in

ventilation equipment, ductwork, and plenum enclosures for inspection and cleaning of outdoor air intakes, mixing plenums, up and downstream of coils, filters, drain pans and fans.

- B. Practice source control and eliminate potential contaminants in material selection, installation, and maintenance.
- C. Provide installation and disposal instructions for all materials and chemicals that are potential contaminants.
- D. Obtain and conform to the requirements of the Material Safety Data Sheets (MSDSs) in the use of materials.
- E. Utilize manufacturer's recommendations and provide installation instructions for all chemicals, compounds, and potential contaminants including pre-installation degassing if required.
- F. Ventilate completed building prior to final completion using no less than design outside air for at least 48 hours before occupancy.
- G. Make provisions for controls to prevent the entry of air contaminants into the HVAC air distribution system.
- H. Steps shall be taken to ensure that the HVAC system continues to function effectively and are not damaged or contaminated during construction activities.

END OF SECTION

SECTION 23 05 12

SHOP DRAWINGS, COORDINATION DRAWINGS AND PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by these specifications as outlined below.
- B. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- C. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: $\frac{1}{4}" = 1'-0"$.
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
 - 1. Actual mechanical equipment and components to be furnished
 - 2. Service clearance
 - 3. Relationship to other equipment and components
 - 4. Roof drains and leader piping
 - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
 - 1. Ductwork shop drawings
 - 2. Coordination drawing specified in Division 26

- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
 - 1. Field measurements
 - 2. Field construction criteria
 - 3. Manufacturer's catalog numbers
 - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
 - 1. Proper sizes and capacities
 - 2. That the item will fit in the available space in a manner that will allow proper service
 - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
 - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
 - 2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name, address and contact number.
 - 4. The number of each Shop Drawing, Project Datum and Sample submitted
 - 5. Other pertinent data
- D. Submittals shall include:
 - 1. The date of submission
 - 2. The project title and number
 - 3. Contract Identification
 - 4. The names of:
 - a. Contractor
 - b. Subcontractor
 - c. Supplier
 - d. Manufacturer
 - 5. Identification of the product
 - 6. Field dimensions, clearly identified as such
 - 7. Relation to adjacent or critical features of the work or materials
 - 8. Applicable standards, such as ASTM or federal specifications numbers
 - 9. Identification of deviations from contract documents
 - 10. Suitable blank space for General Contractor and Architect/Engineer stamps
 - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
 - 1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
 - 2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
 - 1. The related specification section number
 - 2. The exact specification section title
- B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
 - 1. Indicate that the document or sample is a re-submittal
 - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
- C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
 - 1. Review identified submittals with reasonable promptness and in accordance with schedule
 - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
 - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
 - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
 - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 23 05 14

HVAC CONDENSATE DRAIN PIPING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide and install air conditioning condensate drains.

1.2 RELATED WORK

- A. Division 23 - Mechanical
 - 1. Insulation
 - 2. Fan/Coil Units
 - 3. Air Handling Units

PART 2 - PRODUCTS

2.1 PIPE MATERIAL

- A. Type "L" copper with drainage pattern fittings in plenum areas. Type PVC with drainage pattern fittings in non-plenum areas.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the system to facilitate easy removal.
 - 1. Use threaded plugged tee at each change of direction to permit cleaning.
 - 2. Install a cleanout every 50 feet of straight run piping
 - 3. Maintain a positive slope on all piping
- B. Install a water seal trap leg based on the fan pressure.
 - 1. Size the length of the trap leg 1 inch larger than the actual system pressure.
- C. Install traps and cleanout as shown in the drawing details.
 - 1. Confirm requirements with manufacturer's installation instructions

3.2 SIZE PIPE AS SHOWN ON DRAWINGS.

- A. Do not install piping sized smaller than the unit drain connection size.

3.3 SECONDARY DRAINS

- A. Provide secondary drains where required by code, shown on the drawings, or where equipment has secondary drain connections.

END OF SECTION

SECTION 23 05 17

HVAC ACCESS DOORS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, fire dampers, air distribution devices and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

- A.16-Gauge frames
- B.14-gauge steel panels
- C. Continuous fully concealed hinges
- D. Flush screwdriver cam lock & cylinder lock for Owner selection
- E. Automatic closing and latching mechanism
- F. Prime coat finish
- G. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation
- H. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

- A. UL listed, 1-1/2 hour Label "B", access doors
- B.16-Gauge stainless steel
- C. 20-Gauge insulated sandwich-type door panel.
- D. Two inch thick with fire rated insulation
- E. Continuous fully concealed hinge
- F. Automatic closing and latching mechanism
- G. Knurled knob and recessed key operation for Owner selection
- H. Interior latch release slide for opening from inside
- I. Prime coat finish
- J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

- A. Milcor

B.MIFAB

C. Acudor

D. Elmdor

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Access doors specified in Division 23 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.
- B. Installation shall be in accordance with the manufacturer's printed instructions.
- C. Minimum size required:
 - 1. 36" x 24" for Mechanical HVAC equipment related items
 - 2. 18" x 18" for electrical related items

END OF SECTION

SECTION 23 05 93

TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Balance, adjust and test the air distribution system including the exhaust system.
- B. Verify and record the duct test results performed by the mechanical contractor.

1.2 RELATED SECTIONS

- A. COORDINATION OF TESTING AND BALANCING

1.3 PAYMENT PROCEDURES

- A. The work of this Section of the Specifications shall bid the project directly to the General Contractor.

1.4 SUBMITTALS

- A. History of the TAB organization.
- B. Agency certification.
- C. Personnel qualifications.
- D. TAB data forms.
- E. Instrumentation list.
- F. Name of the project supervising engineer.
- G. Name and address and contact person of five successfully completed projects of similar size and scope.
- H. To perform required professional services, the balancing agency shall have a minimum of one test and balance engineer certified by the Associated Air Balance Council.

1.5 TAB FIRM QUALIFICATIONS

- A. The organization performing the work shall be a Certified member in good standing of the (AABC) Associated Air Balance Council.
- B. Able to furnish evidence of having contracted for and completed not less than five systems of comparable size and type that have served their Owners satisfactorily for not less than five years.
- C. A specialist in this field and have the personnel, experience, training, skill, and the organization to perform the work.
- D. The balancing agency shall furnish all necessary calibrated instrumentation to adequately perform the specified services. An inventory of all instruments and devices in possession of the balancing agency may be required by the engineer to determine the balancing agency's performance capability.
- E. The balancing agency shall have operated for a minimum of five years under its current name.

- F. Personnel:
 - 1. The project supervisor shall be a Professional Engineer and have:
 - a. Extensive knowledge of the work involved.
 - b. At least five years of experience conducting tests of the type specified.
 - c. This test and balance engineer shall be responsible for the supervision and certification of the total work herein specified.
 - 2. All work shall be conducted under the direct supervision of the supervising engineer.
 - 3. Technicians shall be trained and experienced in the work they conduct.

1.6 WARRANTY

- A. Provide (AABC) guarantee in writing.
- B. Extended warranty.
 - 1. Include an extended warranty of 2 years after completion of test and balance work, during which time the Architect/Engineer may request a retest or resetting of any outlet or other items as listed in the test report.
 - 2. Provide technicians and instruments to assist the Architect/Engineer in making any tests he may require during this period.
 - 3. The balancing agency shall perform an inspection of the HVAC system during the opposite season from that which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 TAB TOLERANCES

- A. The outside air, supply air, return air, and exhaust air for each system shall be adjusted to within +/- 5% of the value scheduled on the drawings.

3.2 SITE VISITS

- A. During construction, the balancing agency shall inspect the installation of the sheetmetal work, temperature controls, energy management system, and other component parts of the heating, ventilating, and air conditioning systems. One inspection shall take place when 60% of the ductwork is installed and another inspection shall take place when 90% of the equipment is installed. The balancing agency shall submit a brief written report of each inspection to the architect and engineer.
- B. Upon completion of the installation and start-up of the mechanical equipment by the mechanical contractor, the balancing agency shall test and balance the system components to obtain optimum conditions in each conditioned space of the building. If construction deficiencies are encountered that preclude obtaining optimum conditions, and the deficiencies cannot be corrected by the mechanical contractor within a reasonable period of time, the balancing agency shall cease testing and balancing services and advise the architect, engineer, general contractor and owner, in writing, of the deficiencies.
- C. Make one series of visits, phased as required by construction progress, prior to installation of the ceiling. Note proper installation of balancing dampers.
- D. Continue the site visits up to completion of project. In each succeeding report, list corrections made from previous reports.

3.3 TESTING INSTRUMENTS

- A. Submit a list of all instruments to be used for the test and balance procedures.
 - 1. Catalog sheets

2. Certificate of last calibration
 3. Calibration within a period of six months prior to balancing
- B. Testing equipment shall be in good working order and tested for accuracy prior to start of work.

3.4 COORDINATION WITH OTHER SPECIFICATION SECTIONS

- A. Review the related ductwork shop drawings and piping shop drawings. Make recommendations concerning suitability with respect to the testing, balancing and adjusting work.
- C. In cooperation with the work specified in Building Management and Control System section, a systematic listing of the testing and verification shall be included in the final TAB report. The TAB firm shall provide a laptop computer to operate with the Building Management and Control System. Building Management and Control System shall provide all necessary software and special interface cables, as required, to communicate with the DDC system:
1. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of the intended control performance.
 2. Verify that all control devices are properly connected.
 3. Verify that all dampers, valves, and other controlled devices, are operated by the intended controller.
 4. Verify that all dampers and valves are in the position indicated by the controller (open, closed or modulating).
 5. Verify the integrity of valves and dampers in terms of tightness of close-off and full open positions. This includes dampers in multizone units, terminal boxes and fire/smoke dampers.
 6. Observe that all valves are properly installed in piping system in relation to direction of flow and location.
 7. Observe the calibration of all controllers.
 8. Verify the proper application of all normally opened and normally closed valves.
 9. Observe the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts or cold walls.
 10. Observe the location of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media. Control contractor will relocate as deemed necessary by the Engineer.
 11. Verify that the sequence of operation for any control mode is in accordance with the approved shop drawings and specifications. Verify that no simultaneous heating and cooling occurs.
 12. Verify the correct operation of all interlock systems and installation is per the manufacturer recommendations.
 13. Check all dampers for free operation.
 14. Verify that all controller setpoints meet the design intent.
 15. Perform variable volume system verification to assure the system and its components track with changes from full flow to minimum flow.
- D. Upon completion of the testing and balancing, submit three days prior notice that the systems are ready for a running test. A qualified representative of the test and balance organization shall be present, with a representative from the engineer's office, to field verify TAB report readings. Specific and random selections of data recorded in the certified test and balance report will be reviewed.

3.5 INSTRUMENT TEST HOLES

- A. When it is required to make holes in the field to measure temperature, static pressure or velocity in the ducts:
1. Drill holes, plug, and tape external duct insulation.
 2. Repair damaged insulation to Engineer's approval.

3.6 TESTING THE AIR DISTRIBUTION SYSTEM

- a. The TAB agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set full open. The TAB agency shall perform the following TAB procedures in accordance with the AABC National Standards and all results shall be recorded in the TAB report:
3. Terminal Units:
 - a. Set and record volume regulators on all terminal units to meet design maximum and minimum CFM requirements.
 - b. Identification: Identify the type, location, and size of each terminal unit. This information must be recorded on the terminal box data sheets.
4. Diffusers, Registers and Grilles:
 - a. Tolerances: Test, adjust, and balance each diffuser, grille, and register to within 5% of design requirements. Minimize drafts. Observe throws are in direction as indicated on drawings.
5. Coils:
 - a. Air Temperature: Once air flows are set to acceptable limits, take wet bulb (cooling coil only) and dry bulb air temperatures on the entering and leaving side of each coil. Calculate the sensible and latent (cooling coil only) capacity of the coil. Provide information in TAB report.
 - b. Record preliminary air handler data, including fan RPM and static pressures across filter, fans and coils.
- B Perform a velocity traverse of the main supply ducts using a pitot-tube and inclined manometer to establish initial air delivery. Perform a Pitot-tube traverse of main supply and return ducts, as applicable, to obtain total CFM. If a pitot-tube traverse is not practical, a detailed explanation of why a traverse was not made must appear on the appropriate data sheet.
- C. Make adjustments in fan RPM and damper settings, as required, to obtain design supply air, return air, and outside air.
- D. Measure and adjust all supply and return branches to design air delivery.
- E. Measure and adjust all diffusers to design air delivery to +/- 5% of design requirements.
- F. Make a set of recordings showing final system conditions.

3.8 EQUIPMENT POWER READINGS

- A. Record the following information for each motor:
 1. Equipment designation.
 2. Manufacturer.
 3. Unit model number and serial number and frame.
 4. Motor nameplate horsepower; nameplate voltage; phase and full load amperes.
 5. Heater coil in starter.
 - a. Rating in amperes.
 - b. Manufacturer's recommendation.
 6. Motor RPM/driven equipment RPM.
 7. Power reading (voltage, amperes of all legs at motor terminals).

3.13 DUCT TEST

- A. Test and Balancing Contractor shall verify and record the duct test results. A copy of the duct test results, as completed, shall be submitted to the engineer for review within five days. Provide a complete report of all the duct test results in the final TAB report.

3.14 DIRECT EXPANSION EQUIPMENT

- A. With each unit operating at near design conditions, measure and record the following:
 1. Manufacturer, model number, serial number and all nameplate data.
 2. Ambient temperature, condenser discharge temperature.
 3. Amperage and voltage for each phase.
 4. Leaving and entering air temperatures.
 5. Suction and discharge pressures and temperatures.
 6. Tons of cooling.
 7. Verification that moisture indicator shows dry refrigerant.

3.16 TAB REPORT

- A. The activities described in this specification shall be recorded in a report form; and four individually bound copies shall be provided to the Architect and Engineer. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of the test instruments used and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy any incorrect situation. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operations personnel. Provide a "Preface" which shall include a general discussion of the system and any abnormalities or problems encountered.
- B. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the report must have been recorded on site by the permanently employed technicians or engineers of the TAB firm.
- C. Submit reports on forms approved by the engineer that will include the following data as a minimum:
 1. Title Page
 - a. Company Name
 - b. Company Address
 - c. Company telephone number
 - d. Project name
 - e. Project location
 - f. Project Manager
 - g. Project Engineer
 - h. Project Contractor
 - i. Project Identification Number
 2. Summary of the TAB report data
 3. Index
 4. Instrument List
 - a. Instrument
 - b. Manufacturer
 - c. Model
 - d. Serial Number
 - e. Range
 - f. Calibration Date
 - g. What test instrument is to be used for:
 5. Fan Data
 - a. Location
 - b. Manufacturer
 - c. Model
 - d. Air flow, specified and actual
 - e. Total static pressure (total external) specified and actual
 - f. Inlet pressure
 - g. Discharge pressure
 - h. Fan RPM
 6. Return Air/Outside Air Data
 - a. Identification/location
 - b. Design return air flow
 - c. Actual return air flow
 - d. Design outside air flow

- e. Actual outside air flow
 - f. Return air temperature
 - g. Outside air temperature
 - h. Required mixed air temperature
 - i. Actual mixed air temperature
7. Electric Motors
 - a. Manufacturer
 - b. HP/BHP
 - c. Phase, voltage, amperage, nameplate, actual
 - d. PM
 - e. Service Factor
 - f. Starter size, heater elements, rating
8. V-Belt Drive
 - a. Identification/location
 - b. Required driven RPM
 - c. Drive sheave, diameter and RPM
 - d. Belt, size and quantity
 - e. Motor sheave, diameter and RPM
 - f. Center-to-center distance, maximum, minimum and actual
9. Duct Traverse
 - a. System zone/branch
 - b. Duct size
 - c. Area
 - d. Design velocity
 - e. Design air flow
 - f. Test velocity
 - g. Test air flow
 - h. Duct static pressure
 - i. Air correction factor
11. Air Distribution Test Sheet
 - a. Air terminal number
 - b. Room number/location
 - c. Terminal type
 - d. Terminal size
 - e. Correction factor
 - f. Design velocity
 - g. Design air flow
 - h. Test (final) velocity
 - i. Test (final) air flow
13. Cooling Coil Data
 - a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Entering air DB temperature, design and actual
 - f. Entering air WB temperature, design and actual
 - g. Leaving air DB temperature, design and actual
 - h. Leaving air WB temperature, design and actual
 - m. Air pressure drop, design and actual
 - n. Capacity - sensible and latent
14. Heating Coil Data
 - a. Identification/number
 - b. Location
 - c. Service
 - d. Manufacturer
 - e. Entering air DB temperature, design and actual
 - f. Leaving air DB temperature, design and actual
 - k. Air pressure drop, design and actual
 - l. Capacity
16. Sound Level Report

- a. Location (Location established by the design engineer)
- b. N C curve for eight (8) bands-equipment off
- c. N C curve for eight (8) bands-equipment on
- 17. Vibration Test on equipment having 10 HP motors or greater in size.
 - a. Location of points:
 - 1) Fan bearing, drive end
 - 2) Fan bearing, opposite end
 - 3) Motor bearing, center (if applicable)
 - 4) Motor bearing, drive end
 - 5) Motor bearing, opposite end
 - 6) Casing (bottom or top)
 - 7) Casing (side)
 - 8) Duct after flexible connection (discharge)
 - 9) Duct after flexible connection (suction)
 - b. Test readings:
 - 1) Horizontal, velocity and displacement
 - 2) Vertical, velocity and displacement
 - 3) Axial, velocity and displacement
 - c. Normally acceptable readings, velocity and acceleration
 - d. Unusual conditions at time of test
 - e. Vibration source (if non-complying)
- 18. Control verification indicating date performed and any abnormalities identified.
 - a. Point Location/Description
 - b. EMS Readout (Setpoint and Actual)
 - c. Actual Readout of all points
 - d. Interlocks
 - e. Safeties
 - f. Variable speed drive tracking with EMS input
 - g. Variable speed drive Bypass operation
 - h. Sequence of operation

END OF SECTION

SECTION 23 05 94

COORDINATION OF TESTING AND BALANCING

PART 1 - TESTING, BALANCING AND ADJUSTING

1.1 WORK INCLUDED

- A. Balancing and adjusting of the environmental systems is specified in Section 23 05 93.
- B. Coordination of the work is specified in this Section.

PART 2 - PRODUCTS / NOT USED

PART 3 - EXECUTION

3.1 COORDINATION

- A. Bring the work to a state of readiness for testing, balancing, and adjusting.
 - 1. Install air terminal devices.
 - 2. Provide specified filters in air handling equipment. Install clean filters just prior to the start of the test and balance work.
 - 3. Verify lubrication of equipment.
 - 4. Install permanent instrumentation.
 - 5. Clean piping systems and fill with clean water.
 - 6. Complete "Start-up" of equipment.
 - 7. Check rotation and alignment of rotating equipment and tension of belted drives.
 - 8. Verify ratings of overload heaters in motor starters.
 - 9. Verify that safety and operating control set points are as designed and automatic control sequences have been checked.
 - 10. Provide control diagrams and sequence of operation.
 - 11. Collect material for maintenance manuals and prepare one manual especially for use in testing and balancing.
 - 12. Verify that graphic operational data such as start/stop instructions, valve tag schedules, and piping identification schedules have been provided where needed.
 - 13. Verify that equipment and piping identification work has been completed with valve tags, schedules, and piping identification system.
 - 14. Comb out fins on extended-surface heat transfer coils where damaged.
 - 15. Clean all strainers as required.
 - 16. Remove construction strainers after water is cleaned and treated.
 - 17. Remove all temporary filters from HVAC equipment.
 - 18. Provide start-up reports listing all start-up information and manufacturer's information attached.
- B. Provide and install new pulleys and belts as required to effect the correct speed ratio. Adjustments where no belt or pulley change is required, is specified in Section 23 05 93.
- C. Verify that the systems are ready for balancing and adjusting.
- D. Submit a letter stating:
 - 1. The specified pieces of equipment have been checked, started, and adjusted by the manufacturer.
 - 2. Other equipment has been checked and started.
 - 3. The systems have been operated for the specified period of time.
 - 4. The automatic controls system has been adjusted, calibrated, and checked, and is operating as specified.
- E. Provide the services of a technician full time at all times at the project when testing, balancing and adjusting work is being conducted.

- F. Provide instrumentation and services to take readings of the required data for the refrigerant circuits.
- G. Provide and install volume dampers required for balancing by the TAB Contractor.

3.2 START-UP OF EQUIPMENT

- A. Pre-start & Start-up equipment using the procedures as recommended by the manufacturers.
- B. Complete start-up of equipment prior to start of testing & balancing.
- C. Submit start-up procedures as outlined by the manufacturers and complete the "HVAC FAN / AIR HANDLING / START-UP REPORT FORM" to Engineer.

HVAC FAN / AIR HANDLING UNIT / START-UP REPORT FORM

[illegible]

END OF SECTION

SECTION 23 07 13

EXTERNAL DUCT INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install external insulation on supply, return, exhaust and outside air ductwork.
- B. External insulation of concealed and exposed ducts is included in this Section. Internal acoustic duct lining is specified under ductwork and not included in this Section.

1.2 RELATED WORK

- A. Division 9 - FINISHES. Painting and Color Coding.
- B. Division 23 - MECHANICAL.
 - 1. Air Handling Units. Internal insulation for air units is specified in the sections on air handling units. The units do not require external insulation.
 - 2. Internal Duct Liner. Internal duct liner is specified in the section on ductwork.
 - 3. Insulation. Refer to specific sections on individual insulation types.
 - 4. Refer to insulation and liner plan detail.

1.3 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship, resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
- C. All duct insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated system is not approved.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated ductwork or other services are tapped, remove existing insulation back to undamaged sections and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.4 APPROVALS

- A. Submittals. Submit product data on each insulation type, adhesive, and finish to be used

in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location, and the manufacturer's installation instructions for each product.

- B. Sample Application. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 INSULATION

- A. Glass fiber rigid duct insulation.
 - 1. Minimum density of 3 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.7 mil aluminum foil reinforced with glass yarn mesh and laminated to 40 lbs. fire-resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
 - 2. Acceptable Manufacturers
 - a. Schuller 814 spin-glas FSK.
 - b. Owens-Corning Type 703 board RKF.
 - c. Knauf 3 PCF FSK.
- B. Glass fiber blanket duct insulation.
 - 1. Minimum density of 1.0 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs. fire resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
 - 2. Acceptable Manufacturers
 - a. Manville R-series Microlite FSKL.
 - b. Owens-Corning ED100 RKF.
 - c. Knauf 1.0 PCF FSK.
- C. Mastics, sealants, coatings and adhesives.
 - 1. Acceptable Manufacturers
 - a. Childers.
 - b. Foster.
 - c. Vimasco.
- D. Fireboard Insulation
 - 1. Totally encapsulated with foil facing.
 - 2. Two hour rated fire protection.
 - 3. Zero clearance to combustible protection.
 - 4. System shall be listed and labeled by an NRTL.
 - 5. Tested per ISO 6944, Type A Duct and achieve a 2 hour rating for stability, integrity and insulation.
 - 6. Provided system is subject to the approval of the Local Authority Having Jurisdiction.
 - 7. Acceptable Manufacturers
 - a. Unifrax ON Fyrewrap Elite 1.5
 - b. Partak Insulation, Inc. Paroc Fireboard
 - c. Thermal Ceramics FireMaster 3M
 - d. Premier Refractories International, Pyroscat.
- E. Rigid Closed Cell Insulation
 - 1. Acceptable Manufacturers

- a. Dow Trymer.
 - b. Phenolic Foam.
- F. Reinforced Foil Tape
 - 1. Acceptable Manufacturers
 - a. Venture 1525CW
 - b. 3" FSK
 - 2. Thickness 6.5 mils
 - 3. Color: silver

2.2 COATING AND ADHESIVE

- A. Coating. Provide Childers CP-38 or Foster 30-80 vapor barrier coating. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
- B. Outdoors: Provide as insulation coating Childers Encacel X or Foster Monolar 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100°F and 90% RH per ASTM F 1249.
- C. Adhesive. Provide Childers CP-82 or Foster 85-20 vapor barrier adhesive.
- D. Reinforcing Mesh. Provide 10 x 10 white glass or polyester reinforcing mesh.

PART 3 - EXECUTION

3.1 FIRE SAFETY REQUIREMENTS

- A. Do not extend duct coverings through walls or floors required to be fire-stopped or required to have a fire resistance rating. Interrupt duct coverings in the immediate vicinity of heat sources such as electric resistance or fuel-burning heater.

3.2 CONCEALED DUCT

- A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing.
- B. Standing Seams. Insulate standing seams and stiffeners, which protrude through the insulation with 0.6 lb. per cubic foot density, 1-1/2" thick, faced, flexible blanket insulation. Insulation shall not prevent adjustment of damper operators.
- C. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 2". In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on twelve inch centers to prevent sagging of insulation.
- D. Ductwork in mechanical rooms is considered concealed spaces.

3.3 EXPOSED DUCT INSULATION

- A. Ductwork in exposed locations is to be insulated with fiberglass rigid / semi-rigid board insulation.
 - 1. Apply fabric and mastic to provide a smooth surface for painting.
- B. Standing Seams: Insulate standing seams and stiffeners which protrude through the insulation with 0.6 lb per cubic foot density, 1-1/2 inch thick, faced insulation. As a vapor seal, use reinforcing mesh with vapor barrier coating. Insulation shall not prevent adjustment of damper operators.

- C. Insulation shall be wrapped tightly on the ductwork. Adhere insulation to ductwork with adhesive. In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on 12 inch centers to prevent sagging of insulation.
- D. Cover all seams, joints, pin penetrations and other breaks with coating reinforced with reinforcing mesh. Fabric shall not be visible after coating.

3.5 KITCHEN GREASE EXHAUST DUCTWORK / KILN DUCTWORK / FUME HOOD DUCT

- A. Secure fireboard insulation to duct with impaling pins and 3" square speed clips. In addition, provide a wire mesh support system and additional sealing or support as required by the code enforcing authority. The insulation support system shall include framed access to allow the insulation to be removed and replaced without damage at the access doors in the duct system for inspection and cleaning. Coordinate location of access openings to correspond accurately. Provide stainless steel banding on 12" centers.

3.6 GENERAL INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Apply insulation on clean, dry surfaces only.
- C. Continue insulation with vapor barrier through penetrations.
- D. Neatly finish insulation at supports, protrusions and interruptions.
- E. Install insulation on clean, dry surfaces, and only after building is weatherproofed sufficiently to preclude any rainwater on insulation.
- F. Apply mastic over the fiberglass reinforcing mesh to a thickness where fabric is not visible after completion.
- G. Install fiberglass blanket duct insulation on top of supply air grilles not fire rated.

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including refrigerant lines and condensate piping.

1.2 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.
- C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated piping system is not acceptable.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 SUBMITTALS

- A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.
- B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

1.4 RELATED WORK

- A. Finishes. Painting and color-coding
- B. Pipe Heat Tracing

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Aluminum Jacketing:
 - 1. ITW Lock-on (Childers)
 - 2. ITW Z-lock (Pabco)
- F. Mastics, Sealants, Coatings and Adhesives
 - 1. Childers
 - 2. Foster
 - 3. Vimasco
 - 4. Armacell 520 Adhesive
- G. Elastomeric Insulation
 - 1. Armacell
- H. Weather Resistant Coating
 - 1. WB Armaflex Finish
 - 2. Foster 30-64

2.2 ELASTOMERIC INSULATION

- A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than $\frac{3}{4}$ " shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test.
 - 1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

2.3 INSULATION/SHIELD AT HANGERS

- A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with $\frac{1}{2}$ " aluminum bands (2) per shield.
 - 1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
 - 2. Minimum thickness of foam glass insulation shall not be less than 1" thick.
- B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

2.4 SEALANT, ADHESIVE AND FINISH

- A. Lap Adhesive. Provide Childers CP-82 or Foster 85-20 adhesive.
- B. Vapor Barrier Finish:
 - 1. Indoors: Provide as insulation coating Childers CP-38 or Foster 30-80, white. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM

- E96.
- 2. Outdoors: Provide as insulation coating Childers Encacel X or Foster 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100°F and 90% RH per ASTM F 1249 and must be Hypalon rubber based.
- 3. Underground: Provide Childers CP-22/24 or Foster 60-25/26 for fittings and areas. Pittwrap cannot be used.
- C. Insulation Joint Sealant. Provide Childers CP-76 or Foster 95-50 vapor barrier sealant.
- D. Metal Jacketing Sealant. Provide Childers CP-76 or Foster 95-44 metal jacketing sealant for all outdoor metal jacketing laps.
- E. Lagging Adhesive. Provide Childers CP-50AMV1 or Foster 30-36.
- F. Other products of equal quality will be acceptable only upon approval.

2.5 ALUMINUM JACKETING

- A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016" thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier.
- B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024" thick.
- C. Straps and Seals. Provide ½" x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

PART 3 - EXECUTION

3.1 REFRIGERANT AND CONDENSATE PIPING

- A. Cover all pipe with elastomeric insulation by slitting tubular sections or sliding unslit sections over the open ends of piping or tubing. Seams and butt joints shall be adhered and sealed using Foster 85-75, Childers CP-82 or Armstrong 520 Adhesive.
- B. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Foster 85-75, Childers CP-82 or 520 Adhesive.
- C. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter.
- D. Outdoor exposed piping shall be painted with two coats of either WB or SB Armaflex finish or Foster 30-64 elastomer foam coating. All seams shall be located on the lower half of the pipe.

3.2 PIPING OUTDOORS ABOVE GRADE

- A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.
- B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
- C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using Childers CP-82 or Foster 85-20 adhesive. Secure fitting insulation covers and segments in place with ½" wide glass filament tape.
- D. Apply a tack coat of fitting vapor barrier coating over the insulation and tape.

- E. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
- F. Apply coating over the fiberglass cloth to a thickness where the mesh is not visible after completion.
- G. Seal ends of pipe insulation with vapor barrier coating at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.
- H. Finish with aluminum jacketing as specified.

3.3 FLANGE, VALVE AND FITTING INSULATION

- A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
 - 1. Apply a tack coat of insulating coating/mastic to the insulated fitting to produce a smooth surface.
 - 2. After mastic is dry, apply a second coat of vapor barrier coating/mastic. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
 - 3. Overlap coating/mastic and fiberglass/polyester reinforcing mesh by 2" on adjoining sections of pipe insulation.
 - 4. Apply a second coat of coating/mastic over the fiberglass/polyester reinforcing mesh to present a smooth surface.
 - 5. Apply coating/mastic to a wet film thickness of 3/64".
 - 6. Fabric shall not be visible after completion.
 - 7. Vapor seal flanges, valves and fittings with Childers CP-38 or Foster 30-80. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
- B. PVC fitting covers are not acceptable.

3.4 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

- A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.
- B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3" to make a weather tight seal with the application of 1/8" bead of Childers CP-76 or Foster 95-44 metal jacketing sealant.
- C. Install straps on 9" centers and at each circumferential lap joint.
- D. Cover and seal all exposed surfaces.
- E. The use of screws and rivets is not approved.
- F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

3.5 MISCELLANEOUS

- B. Install materials after piping has been tested and approved.
- C. Apply insulation on clean, dry surfaces only.

- D. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces.
Provide a minimum of three coats.

3.6 INSULATION THICKNESS

<u>INSULATED UNIT</u>	<u>THICKNESS</u> <u>(Inches)</u>
Refrigerant Piping	1-1/2
Condensate Drains	1

END OF SECTION

SECTION 23 31 13

DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Duct construction, support and accessories. Dimensions shown on the drawings are free area dimensions.

1.2 RELATED WORK

- A. Division 23 Mechanical
 - 1. Air Devices
 - 2. Air Handling Units
 - 3. Insulation
 - 6. Fans
 - 8. Testing, Balancing and Adjusting (TAB) of Environmental Systems
- B. Division 9 – Finishes, Painting and Color Coding

1.3 QUALITY ASSURANCE

- A. The intent of ductwork specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide ductwork in accordance with the specifications for each type of service.
- B. An approved contractor for this work under this division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 5 systems of comparable size and type that have served their owners satisfactorily for not less than 5 years.

1.4 GUARANTEE

- A. Guarantee ductwork for 1 year from the date of substantial completion. The guarantee covers workmanship, noise, chatter, whistling, or vibration. Ductwork shall be free from pulsation under conditions of operation.

1.5 CONTRACTOR COORDINATION

- A. Erect ducts in the general locations shown, but conform to structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the job site and make necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.
- B. Coordinate location of ductwork with structural members and Architectural drawings and requirements.

1.6 SHOP DRAWINGS AND SAMPLES

- A. Submit shop drawings of all ductwork layouts, including enlarged plans and elevations of all air handling equipment, and submit details of duct fittings, including particulars such as gauge sizes, welds, and configurations prior to starting work.
- B. Submit product data and sealing materials to be used.
- C. Submit sound attenuation data.

- D. Submit shop drawings in plan, elevation and sections, and three-dimensional view showing equipment in mechanical equipment areas.

PART 2 - PRODUCTS

2.1 STANDARDS AND CODES

- A. Except as otherwise indicated, sheet metal ductwork material and installation shall comply with the latest edition of SMACNA HVAC Duct Construction Standards. Air distribution devices (such as dampers) included in this specification shall comply with the latest applicable SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems and NFPA 90A.

2.2 DUCT MATERIAL AND CONSTRUCTION

- A. Except for the special ducts specified below use lock forming quality prime galvanized steel sheets or coils up to 60" wide. Stencil each sheet with gauge and manufacturer's name. Stencil coils of sheet steel throughout on 10' centers with gauge and manufacturer's name. Provide certification of duct gauge and manufacturer for each size duct.
- B. Rectangular low and medium pressure duct constructed of sheet metal in accordance with the latest edition of SMACNA HVAC Duct Construction Standards.
- C. Medium pressure oval and round ductwork shall be spiral seam. Spiral lock-seam SMACNA Type RL-1. Fittings shall be welded construction.
 - 1. Galvanized
 - 3. Aluminum
 - 4. Paint Grip
- D. Low pressure round ducts shall be shop fabricated with snap lock longitudinal seams. Ducts shall be constructed for a minimum of 2" w.g. static pressure.
- E. Kitchen exhaust duct: Welded Black steel, minimum 16 gauge

2.3 DUCT SEALING OF SEAMS AND JOINTS

- A. Follow seal classification as indicated in Table 1-2 of SMACNA "HVAC AIR DUCT LEAKAGE TEST MANUAL". Use seal class A for 4" w.g. static. All longitudinal and transverse joints and seams shall be sealed by use of a fireproof, non-hardening, and non-migrating elastomeric sealant. With the exception of continuously welded joints and machine made spiral lock seams, joints and seams made air tight with duct sealer.
 - 1. Indoor applications – Foster 32-14
 - 2. Outdoor applications – Foster 32-17

2.4 FLEXIBLE DUCT LOW PRESSURE

- A. Construction:
 - 1. Continuous galvanized spring steel wire helix, with reinforced metalized cover
 - a. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.
 - 2. UL 181 Class I air duct label
 - 3. Reinforced vapor barrier jacket
 - 4. Rated for use at system pressure (6" wc minimum)
 - 5. Flexible duct connections from lateral taps to variable volume boxes or terminal boxes shall be rated at twice the maximum pressure rating of the medium pressure system.
- B. Fire hazard classification:

1. Flame spread rating 25 maximum.
 2. Smoke developed rating 50 maximum.
- C. Thermal characteristics:
1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
 2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
 3. 2" minimum wall thickness insulation with 1" overlap
- D. Acceptable manufacturers:
1. Flexmaster
 2. Hart & Cooley
 3. Omniair
 4. Peppertree Air Solutions

2.5 FIRE DAMPERS

- A. Fire dampers for required wall ratings that are 95% minimum free area. Provide Type B or Type C UL dampers for low, medium and high-pressure rectangular, square or round ducts. Dampers shall be activated by a fusible link designed to react at 165°F. Install per manufactures recommendations to provide a UL assembly. Provide sealed sleeve to meet desired leakage performance.
- B. Acceptable Manufacturers:
1. Ruskin
 2. Prefco Products
 3. Air Balance
 4. Greenheck, Inc.
 5. Nailor Industries
 6. Pottorff

2.6 WALL LOUVERS

- A. Refer to schedule on drawings. Coordinate with Architectural Drawings.
- B. All louver frames shall be a minimum of 0.08" extruded aluminum. All blades shall be a minimum of 0.081" extruded aluminum. Beginning point of water penetration at 0.01 oz/sq.ft. Shall be a minimum of 800 ft/min.
- C. Provide all louvers with removable aluminum bird screen with 1/4" mesh.
- D. Acceptable manufacturers:
1. American Warming and Ventilation
 2. Arrow
 3. Greenheck
 4. NCA
 5. Pottorff
 6. Ruskin

2.7 DUCT LINING

- A. Duct lining shall be 1" thick, 1-1/2 lb. density, flexible lining coated on the air stream side to reduce attrition. Liner shall be Schuler Lina-Coustic, Certain-Teed Ultralite, or equal meeting requirements of NFPA 90-A. Provide I.A.Q. rated liner.

2.8 CONTROL DAMPERS

- A. Opposed blade dampers for 2-position and modulating control. Construct frames of 13-gauge galvanized sheet metal with provisions for duct mounting. Damper blades not exceeding 8" in width, of corrugated-type construction, fabricated from two sheets of 22-gauge galvanized sheet metal spot-welded together or a single 16-gauge sheet. Make bearings of nylon or

oil-impregnated, sinthered bronze. Make shafts of 1/2" zinc-plated steel. Blades suitable for high velocity performance. Construct damper so that leakage does not exceed 1/2% based on 2000 fpm and 4" static pressure. Provide replaceable resilient seals along top, bottom and sides of frame and along blade edge. Submit leakage and flow characteristics data with shop drawings. Linkage shall be concealed out of the air stream within damper frame to reduce pressure drop and noise.

- B. Acceptable Model is Ruskin Model CD60.

2.9 VOLUME DAMPERS

- A. Manual balancing dampers that meet or exceed the following minimum construction standards:
1. Frame 16-gauge
 2. Blades 16-gauge
 3. Bearings corrosion resistant
 4. Concealed linkage
 5. Opposed blade dampers
- B. Acceptable manufacturer:
1. Ruskin Model MD-35 or approved equal, by
 2. Arrow
 3. American Warming and Ventilating
 4. Nailor Industries
 5. Pottoroff

2.10 ACCESS DOORS

- A. Round spin-in door of galvanized steel.
1. Fire proof sealing gaskets and quick fastening locking devices
 2. Insulated door
 3. Conform to the requirements of the NFPA
 4. Identification and use of each access door
 5. UL label to match the construction in which it is installed
 6. Cable attached to door and outer frame
 7. Low leakage Access Door
- B. Acceptable Manufacturer
1. Flex master, Inspector Series
 2. Approved Equal

2.11 COMBINATION FIRE/SMOKE DAMPERS

- A. Combination fire/smoke dampers meeting the following requirements:
1. Each combination fire/smoke damper shall be 1-1/2 hour fire rated under UL Standard 555, 4th Edition, and shall be further classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.
 2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16-gauge galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible

3. stainless steel compression type.
 4. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.
 5. Each combination fire/smoke damper shall be equipped with a controlled 7 to 15 second heat-actuated release device. The electric EFL shall close and lock the fire/smoke damper during test, smoke detection, power failure or fire conditions through actuator closure springs. To prevent duct and HVAC component damage, the damper shall at all times be connected to the actuator for controlled closure in not less than 7 seconds and no more than 15 seconds. Instantaneous damper closure is unacceptable. After exposure to high temperature of fire, the damper must be inspected prior to reset to ensure proper operation. Release temperature is 165°F.
 6. Provide UL555S qualified electric actuator at 120 VAC.
 7. Provide air-foil type blades.
- B. Provide integral sleeves
- C. Acceptable Manufacturers:
1. Ruskin
 2. Air Balance, Inc.
 3. Greenheck, Inc.
 4. Nailor Industries
 5. Pottoroff

2.12 DIFFUSER FITTINGS LOW PRESSURE TAPS

- A. Fitting shall meet or exceed the following minimum construction standards:
1. Conical with a base diameter two inches larger than the tap diameter.
 2. Construct fitting and damper of galvanized steel in accordance with ASTM A 527, G90 finish.
 - a. Fitting with a 3/16-inch high stop bead approximately 2-1/2-inches from the discharge end of the fitting
 - b. Provide the fitting with a butterfly damper, damper rod, end bearings and heavy duty locking quadrant.
 - c. Size the length of the straight section of the fitting to match the damper blade diameter. Center the damper blade in the straight section.
 3. Match the fitting body gauge to the SMACNA duct gauge, but not less than:
 - a. Through 8 inches: 26 gauge; Damper blade 22 gauge
 - b. 10 inches and 12 inches: 24 gauge; Damper blade 22 gauge
 - c. 14 inches and 16 inches: 22 gauge; Damper blade 22 gauge
 - d. 18 inches and 20 inches: 20 gauge; Damper blade 20 gauge
 4. Fasten damper blade to a 3/8 X 3/8 continuous square rod with minimum (2) galvanized U-bolts.
 5. Support the damper rod to the fitting with airtight nylon end bushings / bearings.
 6. Provide the damper with a self-locking regulator and handle.
 7. Provide a 2" sheet metal stand-off to extend the regulator.
 8. Flex duct grip area – 2 inches behind retaining bead
 9. Flex duct retaining bead – 1 inch from end
 10. Conical length of at least 3 inches
 11. Barrel length of at least 9 inches

2.13 AUXILIARY DRAIN PANS

- A. Galvanized steel, same gauge and same bracing or cross breaks as a duct with same dimensions. Sides of pan turned up to 1-1/2", all joints soldered watertight. Pan is to be large enough to complete cover drip lines of unit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use construction methods and requirements as outlined in SMACNA HVAC Duct Construction Standards as well as SMACNA Balancing and Adjusting publications, unless indicated otherwise in the specifications. Refer to details on the drawings for additional information.
- B. Reinforce ducts in accordance with recommended construction practice of SMACNA. Provide additional reinforcement of large plenums as required to prevent excessive flexing and or vibration.
- C. Cross break or bead sheet metal for rigidity, except ducts that are 12" or less in the longest dimension.
- D. Where ducts pass through walls in exposed areas, install suitable escutcheons made of sheet metal angles as closers.
- E. At locations where ductwork passes through floors, provide watertight concrete curb around penetration.
- F. Support ducts where passing through floors with galvanized steel structural angles of adequate bearing surface.
- G. Metal or lined ductwork exposed to view through grilles, registers, and other openings shall be painted flat black. Do not install grilles, registers, or similar items until painting is complete.
- H. Fire Dampers shall be installed per manufacturer's recommendations to create a UL rated assembly.
- I. Install end bearing at all location where damper shaft penetrates duct wall.
- J. Clean duct to remove accumulated dust. Ducts shall be closed on ends between phases of fabrication to assure that no foreign material enters the ducts.

3.2 DUCTWORK

- A. Construct rectangular ducts and round ducts in accordance with the latest SMACNA HVAC Duct Construction Standards. Use the static pressure specified on the air handling unit schedule or fan schedules as a minimum for duct construction. All ductwork between the variable volume air handling units and the terminal units shall be constructed to the medium pressure ductwork specification.
- B. Provide adjustable, galvanized splitter-dampers, pivoted at the downstream end with appropriate control device at each supply duct split.
- C. For branch ducts wider than 18", and when shown on drawings provide extractors with an appropriate control device at each rectangular zone or branch supply duct connection. Provide controllers for extractors. Branch ducts shall have a 45° angle in the direction of flow. Do not provide extractor at branch ducts to sidewall registers where the registers are within 10 feet of the main duct.
- D. Shop manufactured curved blade scoops may be used for branch duct takeoffs up to 18" wide. Taper scoop blade to the end, to prevent any sagging that may cut into, or damage duct liner if specified during operation.
 - 1. Construct shop manufactured scoops and splitter blades of galvanized sheet metal 2 full gauges heavier than equivalent sheet metal gauge of branch duct (up to 16 gauge).
 - 2. Check extractors, scoops and splitter blades thoroughly for freedom of operation. Oil bearing points before installing.
- E. Use pushrod operator with locking nut and butt hinges assembly.

- F. Provide opposed-blade volume dampers with an appropriate control device in each of the following locations:
1. Return air ductwork
 2. Outside air branch duct
 3. Exhaust branch duct
 4. Exhaust connections to hoods except kitchen grease hoods or equipment
 5. In each zone at multi-zone unit discharge installed downstream of duct mounted re-heat coils
 6. At each outside air and return air duct connection to plenum of constant volume units
 7. At discharge side of constant volume boxes
 8. Where otherwise indicated or required for balancing coordinate location of additional dampers required by TAB Contractor.
 9. Provide multi-blade dampers when blade width exceeds 12". Provide end bearing where damper shaft penetrates duct wall.
- G. Elbows:
1. Rectangular: Where square elbows are shown, or are required for good airflow, provide and install single-wall or airfoil turning vanes. Job-fabricated turning vanes, if used, shall be single-thickness vanes of galvanized steel sheets of the same gauge metal as the duct in which they are installed. Furnish vanes fabricated for the same angle as the duct offset. The use of radius elbows with a centerline radius of not less than 1-1/2 times the duct width may be provided in lieu of vaned elbows where space and air flow requirements permit.
 2. Round Oval Duct. Provide elbows with a centerline radius of 1-1/2 times the duct diameter or duct width. For round ducts, furnish smooth elbows or 5 piece, 90° elbows and 3 piece, 45° elbows.
- H. For control devices concealed by ceilings, furring, or in other inaccessible locations, furnish extension rods and appropriate recessed-type Young regulators, mounted on the surface of the ceiling or the furring, unless specified, or shown otherwise. Provide with chrome plated cover plates. Use only one mitered gear set for each control device.
- I. Install streamline deflectors at any point where dividing a sheet metal duct around piping or where other such obstruction is permitted. Where such obstructions occur in insulated ducts, fill space inside streamliner and around obstructions with glass fiber insulation.
- J. Insulated Flexible Duct:
1. Install in accordance with manufacturer's instructions, and the terms of its UL listing. Duct shall not exceed 6' in length. Make connections by use of sheet metal collars and stainless steel circular screw clamps. Clamps shall encircle the duct completely and be tightened with a worm gear operator to the point that will provide an airtight connection without unnecessary deformation of the duct. Provide one clamp on flexible duct and one clamp on external insulation. Vapor barrier jacket shall be tucked inside to conceal insulation material.
 2. Construct bends over 45° with sheet metal elbows.
- K. Duct Supports:
1. Horizontal ducts up to 40". Support horizontal ducts up to and including 40" in their greater dimension by means of #18 U.S. gauge galvanized iron strap hangers attached to the ducts by a minimum of two locations per side by means of screws, rivets or clamps, and fastened to inserts with toggle bolts, beam clamps or other approved means. Place supports on at least 8' centers. Use clamps to fasten hangers to reinforcing on sealed ducts.
 2. Horizontal ducts larger than 40". Support horizontal ducts larger than 40" in their greatest dimension by means of hanger rods bolted to angle iron trapeze hangers. Place supports on at least 8' centers in accordance with SMACNA Standards.
 3. Support vertical ducts where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles for ducts up to 60". Above 60", the angles shall be increased in strength

- and sized on an individual basis considering space requirements.
- 4. Supports shall be suspended from structural or by independent support. Do not support from structural bridging. Upper attachments should be selected with a safety factor of 4 or 5 times actual load conditions and subject to Engineers approval. Double wrap straps over open web of joist.

- L. Branch connections for medium pressure ductwork shall be made with a conical lateral. Field installed conical branch ducts shall be minimum 20-gauge galvanized sheet metal, "Everdur" welded and coated with "Galvabar".

3.3 PLENUMS

- A. Return air plenums shall be rectangular galvanized sheet metal ductwork.
- B. Fabricate plenums upstream of fan of 16-gauge material.
- C. Fabricate plenums upstream of filters minimum 18-gauge material.

3.4 FLEXIBLE CONNECTIONS

- A. Where ducts connect to fans or air handling units that are not internally isolated, make flexible airtight connections using "Ventglas" fabric. The fabric shall be fire-resistant, waterproof and mildew resistant with a weight of approximately 30 ounces per square yard. Provide a minimum of 1/2" slack in the connections, and a minimum of 2-1/2" distance between the edges of the ducts. Also, provide a minimum of 1" slack for each inch of static pressure on the fan system. Fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands. Where connections are made in outdoor locations, seal fabric to metal with mastic.

3.5 ACCESS DOORS

- A. Install ductwork access doors as noted below, arranged for convenient access. Stencil each door for specific use. Install access doors in each of the following locations:
 - 1. Fire Dampers
 - 6. Control Dampers
- B. Size access door 1" smaller than ductwork.
 - 1. Available Sizes: 8", 10", 12", 18", 24"
- C. Construct access door air tight, and conform to recommendations of NFPA and SMACNA.
- D. Demonstrate suitability of access for the intended purpose. Install multiple access doors as required.

3.7 SEALING OF SEAMS AND JOINTS

- A. Seal supply, return, exhaust and outside air duct systems.

3.8 FLUES

- A. Provide and install flues for all gas fired equipment.
- B. Refer to plans for all related locations.
- C. Contractor is responsible for coordinating stack sizing, stack drains, stack test ports, stack termination fittings and all other required fittings with the selected equipment manufacturers.
- D. All fittings and accessories shall be manufactured by the flue manufacturer. The flue shall be installed per manufacturer's instruction.

- E. Terminate flues at height above roof to prevent flue gas from entering the building.

3.9 KITCHEN EXHAUST DUCT

- A. All material and fittings shall be minimum 16 gauge, coated black steel to prevent rusting. All seams and joints in the kitchen exhaust duct, and penetrations of the hood enclosure to its lower outermost perimeter that directs and captures grease-laden vapors and exhaust gases shall have a liquid tight continuous external weld. All ducts shall be installed without forming dips or traps that might collect residues. Provide 18" x 18" or equal area at each elbow and as required for cleaning access, in direction of air flow. UL Listed access panel shall be located on the vertical wall of the duct 1-1/2" from the bottom of duct and shall be fitted with two handles, grease and air tight fitting access door and latch. All interior surfaces of ducts shall be accessible for cleaning and inspection purposes. Duct shall maintain minimum 1/4" per lineal foot slope to the exhaust hood. Provide duct over lay at the roof curb for a complete seal. Install kitchen exhaust system per local authority. In the absence of a local authority, the requirements of the Uniform Mechanical Code and NFPA 96 shall govern.

3.10 CONNECTIONS TO LOUVERS

- A. Make watertight connections to all louvers. Ductwork behind louver shall have watertight soldered joints for a minimum of three feet and be sloped to bottom of louver. Lap duct to be over bottom louver blade where possible.
- B. Where plenums are installed on inside of louver, construct such that bottom of plenum will lap over bottom blade of louver to drain any water that may enter.

3.11 PLENUMS

- A. Construct plenums with galvanized steel framing members and galvanized sheet steel, cross broken and rigidly braced with galvanized angles. Gauges and bracing shall conform to SMACNA recommendations for ductwork of like sizes. Openings for fans, access doors, etc., shall be framed with galvanized steel angles.
- B. Provide access doors.

3.12 AUXILIARY DRAIN PANS

- A. Where coils that have a condensate drain are located above ceiling.

3.13 TESTING OF LOW PRESSURE DUCTWORK

- A. Test ductwork for leaks before concealing. Maximum allowable leakage is 5% of total airflow.
- B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers and pressure vs CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.
- C. Mains: Test mains after risers and branches are tied in and all equipment set. Close runout connections and place fan in operation. Provide pressure in mains at 1-1/2 times design pressure. Visually inspect joints. Repair leaks detected by sound or touch. Release mains for completion after joints are tight.
- D. Ductwork down stream of terminal boxes, return, exhaust, and outside air ducts are to be visually inspected.

END OF SECTION

SECTION 23 34 16

FANS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install fans, including centrifugal, axial and propeller types, with supplemental equipment.

1.2 RELATED WORK

- A. Division 23 Mechanical:
 - 1. Ductwork
 - 2. Vibration Isolation
 - 3. Air Balance
 - 4. Electrical Provisions of Mechanical Work

1.3 PERFORMANCE

- A. Provide fan type, arrangement, rotation, capacity, size, motor horsepower, and motor voltage as shown. Fan capacities and characteristics are scheduled on the drawings. Provide fans capable of accommodating static pressure variations of +10% of scheduled design at the design air flow.
- B. Rate fans according to appropriate Air Moving and Conditioning Association, Inc. (AMCA), approved test codes and procedures. Supply fans with sound ratings below the maximums permitted by AMCA Standards. All fans provided must be licensed to bear the Certified Ratings Seal.
- C. Statically and dynamically balance all fans.
- D. Motors shall be sized so that they do not operate within the motor service factor.
- E. Fans shall be capable of 120% of the scheduled air capacities.
- F. All static pressures shown on schedules are external to fans. Manufacturer shall add damper and accessory losses to scheduled value before selecting fan.

1.4 SUBMITTALS

- A. Submit fan performance curves with system operating point plotted on curves.
- B. Submit manufacturer's printed installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Cook
- B. Greenheck
- C. Penn Barry Ventilator
- D. Twin City Fans

2.2 PROTECTIVE COATINGS

- A. Manufacturer's Standard. Apply to fans, motors and accessories, the manufacturer's standard prime coat and finish, except on aluminum surfaces or where special coatings are required.
- B. Galvanizing. After fabrication of the parts, hot-dip coat surfaces that require galvanizing. Where galvanizing is specified, a zinc coating may be used. After fabrication, apply the zinc coating and air-dry the coating to 95% pure zinc. Acceptable zinc coatings include Zincilate, Sealube, Amercoat, Diametcoat, or an approved equal.

2.3 SUPPLEMENTAL EQUIPMENT

- A. Motor Covers. Provide weatherproof motor covers for installations out of doors. Apply the same finish as used on the fan.
- B. Safety Disconnect Switch: Provide a factory-wired to motor, safety disconnect switch on each unit.
- D. Relief Vents and Air Inlets: Provide vents and inlets with aluminum frames and 1/2" mesh, galvanized bird screens. Include dampers where shown.
- E. Prefabricated Roof Curbs: Furnish prefabricated roof curbs as detailed. The minimum height is 14". Include a resilient pad on each roof curb so the equipment can be mounted on the top flange for proper seal. Coordinate roof slope and curb to ensure equipment is installed in level position. Provide double shell to protect insulation from damage.
- F. All fans are to be provided with a durable, deep etched, .025" thick, factory installed aluminum identification plate with the following information. Plates are to be furnished with four mounting holes.
 - 1. Fan mark as indicated on the Contract Drawings.
 - 2. Serial number
 - 3. Model number
 - 4. Capacity (CFM) and static pressure.
 - 5. Motor HP
 - 6. Motor Amps
 - 7. Manufacturer
 - 8. Motor phase
 - 9. Number of Belts/Make/Size
 - 10. Motor volts

2.4 VENTILATION AND EXHAUST FANS

- A. Provide the ventilation and exhaust fans shown on the drawings.
- B. Provide each motor with internal overload protection.
- C. Provide each belt driven fan with approved, totally enclosed belt guard.
- D. Provide approved safety screen where inlet or outlet is exposed.
- E. Provide duct flanges where required for connections.
- F. Furnish kitchen hood exhaust fans with vented curb extension that meets NFPA 96, cleanout port, grease tap, curb seal, drain connection and hinge kit.
- G. Furnish supply fans with 1" aluminum, washable filter section.

2.5 ROOFTOP VENTILATION AND EXHAUST SYSTEMS

- A. Provide the rooftop ventilation and exhaust systems shown on the drawings.
- B. Provide each motor with internal overload protection.
- C. Components:
 - 1. Aluminum, stainless steel or plastic coated bird guard.
 - 2. Screws and fasteners of stainless steel or nonferrous material.
 - 3. All aluminum construction unless indicated otherwise on fan schedule.
- D. Welded construction, corrosion resistant fasteners, minimum 16 gauge marine alloy aluminum.
- E. Aluminum base shall be continuously welded curb cap corners.

2.6 GRAVITY ROOF-TOP INTAKE AND RELIEF VENTS

- A. Provide the rooftop intake and relief vent systems shown on the drawings.
- B. Provide with aluminum, stainless steel or plastic coated bird guard.
 - 1. Screws and fasteners of stainless steel or nonferrous material
 - 2. All aluminum construction
- C. Welded construction, corrosion resistant fasteners, minimum 16-gauge marine alloy aluminum.
- D. Aluminum base shall be continuously welded curb cap corners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fans according to the manufacturer's instructions and in the locations shown on the drawings. Ensure fan location is installed at minimum distance from roof edge to meet code requirements.
- B. Do not operate fans or fan powered devices for any purpose until ductwork is clean, filters in place, bearings lubricated and the fan has been run under observation.
- C. Roof mounted fans and gravity roof-top intake and relief vents shall be secured to the curb with stainless steel lag screws at a minimum of 6-inches on center. Follow manufacturer's installation instructions if they are more stringent. Install roof mounted equipment in a level position. Units shall be seated on properly sized curb. Gap between base of the fan and top of the curb shall be sealed with neoprene 1" x 1/4" gasket. Gasket shall be glued or attached with pressure sensitive adhesive.
- D. Install curbs and equipment in level position.
- E. Ceiling mounted in-line centrifugal blowers
 - 1. Shall be suspended from structure with 1/2-inch zinc plated all-thread rods secured to structure.
 - 2. Provide sub-structure where required.
 - 3. Mount bottom of fan no more than 18-inches above the finished ceiling height.

3.2 EXTRA MATERIALS

- A. Provide two sets of belts for each fan, not including the set installed on the fans. Tag set to identify fan.

END OF SECTION

SECTION 23 37 13

AIR DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air distribution devices, including grilles, diffusers, registers, dampers, and extractors.

1.2 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Ductwork.
 - 2. Air Balance.
 - 3. Electrical Requirements for Mechanical Work.

1.3 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

1.4 SUBMITTALS

- A. Submit product data for outlets, grilles, registers, control devices, and similar equipment for review prior to placement of purchase order.
- B. Submittal shall include performance sheet for each air device type. Performance sheet shall include NC levels, throw, and total pressure loss at various air flows.

1.5 FINISHES

- A. Paint exposed devices with factory standard prime coat, or factory finish coat, as specified.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES AND REGISTERS - Refer to Drawing Schedule.

2.2 ACCEPTABLE MANUFACTURERS

- A. Titus.
- B. Krueger.
- C. Nailor Industries.
- D. Price
- E. Metal-Aire

2.3 ACCESSORIES

- A. Supply Grille Extractors. Provide supply grilles with an air control device capable of positively regulating the volume of air extracted from the supply duct.

Select extractors similar to Titus Model AG25, tight-closing in the minimum position. Include a key-operated or worm-gear adjusting mechanism to facilitate positioning from the grille opening. Where adjustment is not accessible at the grille opening, provide a square control

rod equipped with a locking quadrant.

- B. Mounting Frames. Provide each grille or register not equipped with a removable core with a companion, all-purpose mounting frame constructed like grille frame to facilitate installation and removal of the grille or register without marring adjacent mounting surfaces.
 - 1. Furnish frames with 1/2" thick sponge rubber gasket to prevent air leakage.
 - 2. Provide a frame that neatly fits the grille. Mounting frames will not be required for grilles or registers mounted directly on exposed ductwork.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Do not install ceilings adjacent to fixtures until installation of fixtures, air supply assemblies, return-air blank-off strips and flexible duct have been approved. Remove and reinstall any part of the installation found incorrect.

3.2 INSTALLATION

- A. Louvered diffuser outlets mount tight against the ceiling. Fasten outlets to ductwork with sheet metal screws. For perforated diffusers, attach the frame assembly by a concealed hinge assembly to an outer frame compatible with the type of ceiling on which the diffuser is installed.

END OF SECTION

SECTION 23 63 00

AIR-COOLED CONDENSING UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air-cooled condensing units complete with casing, compressor, condenser coil, condenser fan and controls required for a split air conditioning system.

1.2 RELATED WORK

- A. Refrigerant Piping.
- B. Electrical Provisions of Mechanical Work.

1.3 PERFORMANCE

- A. Provide performance as scheduled on drawings, and head pressure control to enable unit to operate in temperatures as low as 20 degrees F. ambient.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Carrier
- B. Trane
- C. Daikin
- D. York

2.2 COMPRESSOR

- A. Provide a hermetic or semi-hermetic compressor with crankcase heaters, inherently protected motors, spring mounts and capacity modulation. Provide each compressor with a 5-year warranty.
- B. Provide refrigerant not scheduled for phase out during the life of the unit.

2.3 CONDENSER COILS

- A. Provide copper tubes with mechanically bonded aluminum fins. Protect condenser coils with a heavy gauge, corrosion resistant wire guard.

2.4 FANS AND MOTORS

- A. Provide propeller-type fans with direct drive or belt drive and vertical discharge. Protect fan with a heavy-gauge, corrosion resistant wire guard. Provide inherently protected, permanently lubricated, and weatherproof motors.

2.5 CASING

- A. Furnish a unit designed for outdoor mounting. Fabricate the casing of heavy gauge steel, zinc coated and finished with enamel. Provide removable access panels.

2.6 CONTROLS

- A. Provide safety and operating controls factory wired and mounted in a separate enclosure. Include thermostatic expansion valve, high and low pressure switches and compressor motor overload devices. Furnish a time delay device to prevent short cycling. Employ a control transformer, a pressure relief device and suction and discharge valves with service connections. Devices shall be wifi compatible for remote access with application on phone.

2.7 THERMOSTAT

- A. Low voltage, 7-day programmable thermostat is a component of the unit manufacturer unless specified in another Section.
 - 1. Individual Heating/Cooling setpoints.
 - 2. Automatic Heat/Cool change-over.
 - 3. Sub-Base On-Off-Auto fan selection.
 - 4. Sub-Base Heat-Off-Cool-Auto system selection.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount condensing units on 4" foundation pads and pipe as shown on Drawings or as recommended by the equipment manufacturer. Install removable core refrigerant filter dryer and sight indicating glass.

3.2 CONTROL WIRING

- A. Furnish and install control wiring as required. Install control wiring in conduit.

END OF SECTION

SECTION 23 73 13

AIR HANDLING UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air handling units with casing, fans, coils, filters and special items.

1.2 RELATED WORK

- A. Division 23 Mechanical
 - 1. Air Balance
 - 2. Ductwork
 - 3. Controls
 - 4. Electrical Provisions of Mechanical Work
 - 5. Air Filtration
 - 6. Heating and Cooling Coils
 - 7. Other applicable sections

1.3 PERFORMANCE

- A. Unit capacities and characteristics as indicated.
 - 1. Units must be certified in accordance with ARI Standard 430-66.
 - 2. UL 1995 certification for safety including electric heat.
 - 3. ARI 430 listed and meet NFPA 90A requirements.

1.4 SHOP DRAWINGS

- A. Indicate assembly, unit dimensions, weight loading required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- B. Submit fan performance curve for each unit:
 - 1. Plot fan volume against static pressure, horsepower and efficiency.
 - 2. Show point of rating based on static requirements of the system.
 - 3. Chart of specific sound power level at each octave band center frequency.
 - 4. For variable volume units, plot fan volume over entire range.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly tapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been tested under observation.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Inspect for transportation damage and store in a clean, dry location. Protect from weather and construction traffic.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Carrier
- B. Trane

- C. York
- D. Daikin

2.2 MISCELLANEOUS REQUIREMENTS

- A. Provide factory assembled units. Large units may be shipped in sections, at contractor's option, to enable entrance to building, or for oversize shipping reasons only.
- B. Furnish units with sealing and fastening hardware supplied by the manufacturer. Include written instructions needed to complete field assembly of the components.
- C. Provide units designed and constructed so that coils, panels, fan housing and fans can be removed without affecting the structural integrity of the unit.
- D. Unit casing panels shall be a minimum of 2" double wall construction with solid galvanized exterior and solid galvanized interior. Panels shall have a minimum thermal resistance of R-13. The casing shall not exceed 0.0042 inch deflection per inch of panel span at 1.5 times the design static pressure up to a maximum of +8 inches in all positive pressure sections and -8 inches in all negative pressure sections.
- E. Provide full perimeter base rail channel under units constructed of heavy gauge galvanized steel (minimum 10 gauge) and intermediate cross members to assure unit integrity. Provide minimum size base rail to ensure proper trapping and slope of condensate drain (minimum 6 inch from bottom of drain opening).
- F. Fan assembly shall be provided with 1" deflection internally mounted spring vibration isolation under the fan and motor base on units with coils less than 8 sq. ft. and 2" deflection internally mounted spring vibration isolation under the fan and motor base with coils greater than 8 sq. Ft. Units with coils over 35 sq. ft. shall have spring thrust restraints securing the fan housing to the discharge opening panel on units. Fan motor shall be internally mounted. Provide internal flex connection of fan discharge. Maximum acceptable RPM of fan shall not exceed 1000.
- G. Provide factory installed removable hinged access doors in the following locations:
 - 1. Entering side of all coils to allow for cleaning of coils on both sides of unit.
 - 2. Each side of filter compartment to allow changing of filters from either side.
 - 3. Each side of motor compartment to allow motor and isolation access.
 - 4. Each side of condensate drain pan to allow for cleaning and inspection.
 - 5. Swing the doors against the casing static pressure.
- H. Provide all coil modules, including heating coil modules, with stainless steel drain pans to facilitate cleaning and maintenance of the coils. Drain pan to extend 10" minimum downstream of cooling coil.
- I. Provide coils with stainless steel casings, end plates, tube supports and top & bottom plates.
- J. Units shall meet ASHRAE III Class 6 Low Leakage Standard. Casing shall have less than a 1% leakage rate at plus or minus 8 inches W.G.
- K. Provide units with a low velocity angled filter section unless otherwise specified.

2.3 DRAW THROUGH AIR HANDLING UNITS CONSTANT VOLUME (DIRECT DRIVE STANDARD MOTORS)

- A. Provided with:
 - 1. Non-Overloading direct drive plenum fans. Provide minimum number of fans as indicated on drawings.
 - 2. Insulated sheet metal cabinet with removable panels for access to the interior.
 - 3. Hinged double wall doors with two-step safety handles.

- B. Drive assembly:
 - 1. Sized for 50% overload.
- C. Motors and Control:
 - 1. Totally enclosed, fan cooled, Variable speed, 1750 rpm.
 - 2. Maximum operating point of 70 Hz.
 - 3. Minimum 90% nominal efficiency at loads of 70%-100%.
 - 4. Premium efficiency inverter duty
 - 5. NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F without tripping overloads.
 - 6. +/- 10% voltage utilization range to protect against voltage variation.
 - 5. Cast iron frame and end plate
 - 6. Forged steel lifting eye
 - 7. Oversized conduit box with ground lug
 - 8. Provide with factory installed shaft grounding rings by Aegis
 - 9. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
- D. Supply Fans:
 - 1. Single width, single inlet, backward curved welded aluminum plenum fan.
 - 2. Statically and dynamically balanced to a BV-3 per AMCA 204 test standard.
 - 3. Tested after being installed in the fan sections.
 - 4. Selected for the design air quantities and pressure of the system.
 - 5. Mounted on a common shaft if multiple wheels.
 - 6. The fan shall be rated in accordance with AMCA 210 for performance and AMCA 260 for sound.
 - 7. Minimum of Class II fan.
- E. Fans selected with isolation shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor to avoid transmission of noise and vibration through the ductwork and building structure.
- F. Each direct drive fan in a multiple-fan array shall be provided with integral back flow prevention: a backdraft damper that prohibits recirculation of air in the event a fan or multiple fans become disabled. Dampers are tested and rated based on AMCA Standard 500. Dampers to be heavy duty type capable of a maximum back pressure that exceeds the design total static pressure with minimal leakage. The dampers should have a minimal total effect on airflow performance; both pressure drop when open and system effect on the fan. The damper blades and frame shall be extruded aluminum with blade edge seals locked into the blade edge. Adhesive type seals are unacceptable. AHU manufacturer responsible for providing proper spacing upstream of dampers to ensure full, uniform airflow through upstream components. For units where the damper(s) are supplied at the jobsite, the installing contractor shall contract a certified TAB contractor to verify uniform airflow thru upstream components.
- G. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
- H. Stainless steel condensate pan with positive slope in all directions to outlet. Line the condensate drain pan with minimum 1-1/2" waterproof insulation.
- I. Insulation, vapor barriers, facings and adhesives shall have:
 - 1. Flame spread not higher than 25.
 - 2. Smoke developed rating not higher than 50.

- J. Double wall casing construction. Construct interior casing panels with 3 lb. minimum density insulation for acoustical and condensation control.
 - 1. Condensation on the exterior of the air handling units is not acceptable.
- K. Filter section:
 - 1. Constructed with substantial hinges.
 - 2. Neoprene gasketing.
 - 3. Permanent quick release latching devices.
 - 4. Arranged to accommodate the 2" thick filters as specified.
- L. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- M. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- N. Provide units with factory fabricated mixing box section that include an additional 2" thick metal perforated inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.
- O. Provide each fan section with an additional 2" thick perforated metal inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.
- P. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install air handling units according to manufacturer's instructions.
- B. Provide additional drive packages as required by the Testing and Balancing firm.
- C. Air leaks detectable by sound or touch are to be corrected.
- D. Air handling units are to be properly supported to prevent flexing, bending or distorting base rails.
- E. All coils are to be cleaned prior to substantial completion if units are used during construction.
- F. Clean all air handling units and return to original manufacturer's condition prior to substantial completion. Vacuum clean all debris from inside air handling equipment.
- G. Install piping to unit with full size 6 inch long dirt leg with 1/2" valve at bottom for cleaning.
- H. Provide for positive gravity drainage of coil condensate. Pipe full size of unit connection.
- I. Adjust fan drives as required to obtain scheduled capacities as directed by the Test and Balance Firm to include sheave and belt replacement.
- J. Align belts to eliminate wear and vibration of belts.
- K. Verify correct drainage of condensate from condensate pan.
- L. Verify correct rotation of fan and wiring of motor.
- M. Lubricate all greaseable ball bearings with manufacturer's suggested lubricant.

- N. Replace filters as required if units are used during construction.
- O. Provide piping installation so that after piping is completed and insulated there is full access to service unit and remove fan housing. Piping to coils shall not block fan section access or cause damage to piping insulation during access.

3.2 IDENTIFICATION

- A. Furnish each unit with a durable, deep etched, .025" thick, factory installed aluminum identification plate, permanently mounted with the following information:
 - 1. Unit identification as indicated on Contract Drawings.
 - 2. Serial Number.
 - 3. Model Number.
 - 4. Capacity (CFM) and static pressure.
 - 5. Motor HP.
 - 6. Unit power supply: Volts / PH / Amps.
 - 7. Supply Fan Type.
 - 8. Coil GPM and pressure drop.
 - 9. Sales Order #.
 - 10. Date unit manufactured.

END OF SECTION

SECTION 23 82 18

DUCTLESS MINI SPLIT DX UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install mini split system. Unit shall be provided with constant speed compressor, pre-charged with refrigerant. air-cooled condensing units complete with casing, compressor, condenser coil, condenser fan and controls required for a split air conditioning system.

1.2 RELATED WORK

- A. Refrigerant Piping.
- B. Electrical Provisions of Mechanical Work.

1.3 PERFORMANCE

- A. Provide performance as scheduled on drawings, and head pressure control to enable unit to operate in temperatures as low as 20 degrees F. ambient.

1.4 QUALITY ASSURANCE

- A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and bear the ETL label.
- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- C. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210 and bear the AHRI Certification label.
- D. The units shall be manufactured in a facility registered to ISO 9001 Quality assurance Standards and ISO 14001 which are set of standards applying to sustainability and environmental protection set by the International Standard Organization (ISO).
- E. A pressure charge of refrigerant sufficient for up to twenty-five (25) feet of refrigerant tubing shall be provided in the outdoor condensing unit.
- F. A dry air holding charge shall be provided in the indoor section.
- G. System efficiency shall meet or exceed 13.0 SEER.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Daikin
- B. Trane / Mitsubishi Electric

2.2 INDOOR UNIT GENERAL

- A. The indoor shall be factory assembled, wired and run tested. Contained within the unit cabinet shall be all factory wiring, internal piping, electronic control circuit board and fan with fan motor.

- B. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and auto restart after power interruption function, an emergency operation function and a test run switch.
- C. Indoor unit and refrigerant pipes shall be charged with dry air before shipment from the factory. All refrigerant piping must be insulated.

2.3 UNIT CABINET

- A. The casing shall have a smooth front, top return, in a Munsell No. 1.0Y 9.2/0.2 white finish.
- B. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.
- C. There shall be a separate installation plate which secures the unit firmly to the wall. Secure mounting of plate and all mounting hardware shall be furnished by and be the responsibility of the installer.

2.4 FAN

- A. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor mounted in rubber motor mount.
- B. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
- C. Manual adjustable vertical guide vanes shall be provided with the ability to change the airflow from side to side (left to right).
- D. An integral, motorized, horizontal air sweep flow louver shall provide an automatic change in airflow by directing the air up and down to provide for uniform air distribution.
- E. The indoor unit fan motor shall operate in four (4) selectable speeds, Powerful, High, Medium, and Low.

2.5 FILTER

- A. Return air shall be filtered by means of easily removed, washable, Catechin air filter and an anti-allergy enzyme filter – blue bellows type.

2.6 COIL

- A. The indoor unit (evaporator) coil shall be of nonferrous construction with smooth, pre-coated aluminum fins on copper tubing.
- B. Tubing shall have inner grooves for high efficiency heat exchange.
- C. All tube joints shall be brazed with PhosCopper or silver alloy.
- D. The coil shall be pressure tested at the factory.
- E. A sloped condensate pan and drain with extension hose shall be provided under the coil. Drain connections shall be provided at each end of the drain pan. (Option: A condensate mini-pump shall be provided to provide a means of condensate disposal when a gravity drain is not available.)

2.7 ELECTRICAL

- A. Power for the indoor unit shall be supplied from the outdoor unit using three (3) fourteen (14)

gauge AWG conductors (N, L1, 2) plus ground wire connecting the units.

- B. Power supply shall be 115 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 103 volts to 127 volts. Wiring shall be 14.
- C. The unit shall be equipped with a micro-processor control system directing indoor and outdoor unit coordinated operation.
- D. The indoor unit shall not have any supplemental electrical heat elements.

2.8 CONTROL

- A. This system shall have a hardwired controller to perform input functions necessary to operate the system. The controller shall consist of a Power On / Off switch, Mode Selector, Temperature Setting, Timer Control, Fan Speed Select and Auto Vane Selector.
- B. Temperature changes shall be by 1°F increments with a range of 65°F to 87°F.
- C. There shall be a 24 hour On / Off timer.
- D. The unit shall have an emergency operation mode to allow operation without the remote controller.
- E. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless remote controller, providing emergency operation and controlling the outdoor unit.
- F. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.
- G. The system shall be capable of automatic restart when power is restored after power interruption.
- H. The control system shall control the operation of the air sweep louvers, as well as provide on / off and system / mode function switching.

2.9 OUTDOOR UNIT GENERAL

- A. The outdoor unit is designed specifically for use with series indoor units. These units are equipped with a circuit board that interfaces to the indoor unit circuit board. The outdoor unit shall be completely factory assembled, internally piped and wired. Each unit shall be run tested at the factory.
- B. When refrigerant lines are exposed on exterior of building provide "LINE-HIDE" line set cover system.
 1. Material, Weather resistant, UV stabilized, ASA/PVC/ABS/Poly/PE
 2. Assembly Screws, stainless steel.

2.10 UNIT CABINET

- A. The casing shall be fabricated from zinc coated steel, bonderized with an electrostatically applied, thermally bonded, acrylic or polyester powder coating for corrosion protection.
- B. Case and mounting feet shall be as follows:
 1. The MS-A09WA base shall be of Aluminum-Zinc-Magnesium alloy coated steel, with welded mounting feet.
 2. The base for the MS-A12WA shall have a galvanized steel base with welded mounting feet.
- C. Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed

conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

2.11 FAN

- A. The unit shall be furnished with a directive drive propeller type fan, statically and dynamically balanced for smooth and quiet operation.
- B. The fan motor shall have inherent protection, be equipped with permanently lubricated bearings. The fan motor shall be mounted and isolated for quiet operation.
- C. The fan shall be provided with a raised guard to prevent contact with moving parts.
- D. The outdoor unit shall have horizontal discharge airflow.

2.12 COMPRESSOR

- A. The compressor shall be a high performance, hermetic, rolling piston, rotary type.
- B. Compressor shall be mounted using rubber isolating bushings to avoid the transmission of vibration.
- C. Compressor shall be protected by an automatic over current relay and a thermal overload switch.

2.13 OPERATION

- A. The outdoor unit shall have an accumulator.
- B. The outdoor unit must have the ability to operate with a maximum height difference of 35 feet between indoor and outdoor units.
- C. The unit shall have a maximum refrigerant tubing length of 65 feet between indoor and outdoor units without the need for line size changes, traps or additional oil. All refrigerant lines must be insulated.
- D. The unit shall be pre-charged for a maximum of 25 feet of refrigerant tubing.

2.14 ELECTRICAL

- A. The electrical power of the system shall be 115 volts, 1 phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 103 volts to 127 volts.
- B. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount condensing units on 4" foundation pads and pipe as shown on Drawings or as recommended by the equipment manufacturer. Install refrigerant filter dryer and sight indicating glass.
- B. Install units on vibration isolation pads.

3.2 CONTROL WIRING

- A. Furnish and install control wiring as required. Install control wiring in conduit.

3.3 DELIVERY, STORAGE AND HANDLING

- A. Unit shall be stored and handled according to the manufacturer's recommendations.
- B. The wireless controller shall be shipped inside the carton with the indoor unit and able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

3.4 WARRANTY

- A. The units shall have a manufacturer's parts and defects warranty for a period five (5) years from the date of the original installation. The compressor shall have a warranty of seven (7) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.

3.5 START-UP

- A. Follow the manufacturer's start-up procedures.
- B. Provide flexible elastomeric rubber closed cell insulation to prevent condensation from occurring on suction piping. After completion of successful start-up, installing contractor shall seal all openings in insulation and apply a protective aluminum sheetmetal jacket over insulation exposed on exterior of building.

END OF SECTION

SECTION 23 82 39

ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide and install electric unit heaters complete with heating element, propeller mounting brackets and other options as specified.

1.2 RELATED WORK

- A. Division 23 - Mechanical.
 - 1. Electrical Provisions of Mechanical Work.
 - 2. Ductwork.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Modine
- B. Reznor
- C. Chromalox
- D. Trane
- E. Markel

2.2 COMPONENTS

- A. Casing:
 - 1. Construct casing of sheetmetal with a structural frame.
 - 2. Enamel or lacquer finish to manufacturers standard.
- B. Electric Heating Elements:
 - 1. Shall bear the UL label.
 - 2. Corrosion resistant materials.
 - 3. Heating coil of 80-20 nickel-chrome wire.
- C. Components:
 - 1. Fused control circuits
 - 2. Contactors in accordance with the staging requirements
 - 3. Control power transformer
 - 4. Control voltage 120
- D. Louvers:
 - 1. Adjustable vertical and horizontal louvers for air discharge.
- E. Mounting brackets:
 - 1. As indicated

2.3 CONTROLS

- A. Automatic controls:
 - 1. Factory mounted
 - 2. Prewired to the junction box

3. Unit mounted thermostats 24-volt low voltage

B. Safety Controls:

1. A primary and secondary thermal cut-off to de-energize each circuit.
2. Manual reset high limit
3. Automatic reset thermal protection

2.4 FAN

A. Propeller blade fan:

1. Construct the fan of aluminum or other corrosion-resistant material.
2. Statically and dynamically balanced
3. Substantial fan guard

2.5 MOTOR

A. Totally enclosed ball bearing motor:

1. Permanently lubricated bearings
2. 120 volt, single phase, 60 cycle motor
3. Sized to operate the fan at the required capacity

2.6 ELECTRICAL

A. Single point connection:

1. Factory wiring
2. Only direct line supply and thermostat field connections
3. Terminal blocks for line voltage wiring
4. Wiring diagram permanently attached
5. Balance phases

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Furnish units with suitable connections for mounting as shown or as otherwise approved.
- B. Provide start-up to ensure correct operation of unit.
- C. Adjust discharge louvers to control direction of air flow.

END OF SECTION

SECTION 26 05 00

ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 1 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 26 Electrical.
- B. Applicable provisions of this section apply to all sections of Division 26, Electrical.

1.2 CODE REQUIREMENTS AND FEES

- A. Electrical work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories,
 - 2. National Fire Protection Association,
 - 3. State Health Department,
 - 4. Local Municipal Building Inspection Department adopted codes with amendments,
 - 5. National Electrical Code with local amendments.
- B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract.
- C. Obtain all permits required & pay all fees for such permits.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than three (3) systems of comparable size and type that have served their Owners satisfactorily for no less than three (3) years.

1.4 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.5 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide a manufacturer's qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing and adjusting of equipment.
- B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect/Engineer.

1.7 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.
- B. Every effort has been made by the Engineer to indicate wiring of all receptacles, light fixtures, switches, telephone outlets, HVAC equipment, other equipment, elevator equipment, and all other devices / appliances requiring electrical power. It is the intent of the Engineer that all light fixtures be powered and controlled unless specifically noted on the plans; that all wiring devices (receptacles and direct connected equipment) be circuited to a power source of the correct voltage, unless specifically noted on the drawings; and that all HVAC, elevator equipment and other equipment be properly wired to the correct voltage power source; that all communications and security systems devices and equipment and all fire alarm system devices and equipment are installed, wired and systems are fully operational.
- C. It is the responsibility of the Contractor to review the architectural drawings (reflected ceiling plans) for light fixtures, casework elevation details for electrical devices which are not indicated on the electrical drawings; to review the mechanical and plumbing documents and other consultant equipment drawings to determine the electrical rough-ins for all equipment requiring power connections, and to include in their proposals the correct and complete electrical rough-ins for all of these items which were inadvertently not indicated on the electrical drawings, OR the Contractor shall specifically enumerate each item requiring electrical rough-in which is not specifically shown on the electrical drawings, and indicate the electrical provisions of these items as specifically excluded from his proposal.

1.8 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under slab service and feeders installed, dimensioning exact location and elevation of such installations.

1.9 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.10 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and

locate bolts and fittings required to be cast in them. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

1.11 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.12 GUARANTEE

- A. Guarantee work for one (1) year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.13 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two (2) or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.14 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.15 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 26 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, materials, energy efficiency characteristics (where applicable) and lighting performance characteristics (where applicable) equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted seven (7) days before bid due date. Submit a marked-up set of the relevant specification section indicating all variances, a comparison to the specified product, and of construction and performance criteria, complete design and performance data for the specified product and the proposed substitution for comparison to the Engineer. The Architect issues approvals of acceptable manufacturers as addenda to the Construction Documents.

1.16 UTILITIES, LOCATIONS AND ELEVATIONS

- A. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.17 WARRANTIES

- A. Submit three (3) copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.18 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Contract Drawings, details and specifications and thoroughly familiarize himself as to the construction and all job related requirements. All construction trades shall cooperate with the General Contractor /

Construction Manager job site superintendent and lay out work so that all raceways and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.19 TEMPORARY FACILITIES

- A. General: Refer to Division 1 for general requirements on temporary facilities.
- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under this Division. Installation of temporary power shall be in accordance with NEC Article 527.
- C. Temporary facilities, wire, lights, and devices are the property of this Contractor and shall be removed by this Contractor at the completion of the Contract.
- D. Prior to shutdown of existing power, provide at minimum 120/240 volt, 1-phase, 3-wire electrical service to provide temporary power to all critical loads as identified by Owner including but not limited to all security systems, fire alarm panel and associated remote power supplies. Contractor shall coordinate directly with local utility regarding temporary power service and metering and shall provide all necessary permits and fees at no cost to the Owner.
- E. Provide a minimum 30-space panelboard with required branch circuit breakers as required and all associated temporary wiring as required. Remove all temporary power prior to substantial completion.

1.20 ELECTRICAL OPERATION AND MAINTENANCE MANUAL

- A. Content of Manual:
 - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer
 - 2) Maintenance contractor as appropriate
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement
 - d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
 - 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information.
 - 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems
 - 2) Control and flow diagrams
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 - 4. Written text as required to supplement product data for the particular installation.
 - 5. Copy of each warranty, bond and service contract issued
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure
 - 2) Instances that might affect validity of warranties or bonds
 - 6. Shop drawings and product data as specified.

- B. Sections for Equipment and Systems:
1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts:
 - b. Operating procedures:
 - 1) Start up, break-in, routine / normal operating instructions
 - 2) Regulation, control, stopping, shut down and emergency instructions
 - 3) Summer and winter operating instructions
 - 4) Special operating instructions
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting
 - 3) Disassembly, repair and reassembly
 - 4) Alignment, adjusting and checking
 - 5) Routine service based on operating hours
 - d. Servicing and lubrication schedule
 - 1) List of lubricants required
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Copies of typed circuit directories of panel board to reflect actual room graphics numbers and room names (not architectural room numbers from the drawings).
 - 1) Electrical
 - 2) Controls
 - 3) Communications
 - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Predicted life of part subject to wear
 - 2) Items recommended to be stocked as spare parts
 - h. Schedule of fuses
 - i. Complete equipment field accessible internal wiring diagrams
 - j. Schedule of light fixtures
 - k. Each Contractor's coordination drawings
 - 1) As installed color coded piping diagrams.
 - l. List of original manufacturer's spare parts and recommended quantities to be maintained in storage
 - m. Other data as required under pertinent sections of the specifications
 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
 4. Provide complete information for products specified in Division 16.
 5. Provide certificates of compliance as specified in each related section.
 6. Provide start up reports as specified in each related section.
 7. Provide signed receipts for spare parts and material.
 8. Provide training report and certificates.

1.21 SHOP DRAWINGS AND PRODUCT DATA

- A. Submittals shall not be combined or bound together with any other material submittal.
- B. Submittal Specification Information:
1. Every submittal document shall bear the following information as used in the project manual:
 - a. The related specification section number
 - b. The exact specification section title
 2. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.
- C. Submit individually bound shop drawings and product data for the following when specified or

provided:

1. Enclosed Switches and Circuit Breakers
2. Enclosed Motor Controllers
3. Panelboards and enclosures
4. Wiring devices
5. Switchboards
6. Lighting fixtures, ballasts and lamps
7. Site Lighting Poles, Fixtures, Ballast and Lamps
8. Architectural Dimming Systems
9. Emergency/Standby generator sets and transfer switches
10. Electrical controls and time switches
11. Surge Protection Devices
12. Electrical Contactors
13. Lighting Controls and Occupancy Sensors

- D. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavate trenches for underground raceways to the required depth to ensure minimum coverage.
- B. Backfill shall not be placed until the work has been inspected, tested, and approved. Complete backfill to the surface of natural ground or to the lines and grades shown on drawings. Except where special materials are required by other Divisions, use stabilized sand to six inches above conduits, continue backfill with select fill material. Do not use peat, silt, muck, debris or other organic materials. Deposit backfill in uniform layers and compact each layer as specified in other Divisions.

3.2 IDENTIFICATION OF EQUIPMENT

- A. Identification of Equipment:
1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions.
 2. Three layer laminated plastic engraved identifying nameplate shall be permanently secured to each switchboard, distribution panel, motor control center, transformer, panelboard, safety disconnect switch, enclosed circuit breaker, wireway, busduct plug, terminal cabinet, surge protective device, capacitor, individual motor controller, contactor, fire alarm panels (main and remote booster), and communications (voice, data, video) cabinet or rack and rooftop equipment (ie: supply and exhaust fans, rooftop HVAC equipment) with stainless steel screws.
 - a. Utility Power: White letters on black background
Generator Power (Emergency): White letters on red background
Load Bank Circuits: White letters on green background
 - b. Identifying nameplates shall have ½-inch high, engraved letters for equipment designation and ¼-inch letters indicating source circuit designation, (i.e., "PANEL HA –served from MDP-6 located in Mech. Rm. 100").

- c. Each switchboard, distribution panel, and motor control center branch circuit device shall have a nameplate showing the load and location of load served in ¼-inch high, engraved letters. Circuit breaker name and kirk key if applicable.
 - d. Each section of multiple section panelboards shall also indicate panelboard section number (i.e., Panel “HA-Section 2 – served from MDP-6 located in Mech. Rm. 100”)
 - e. Enclosed switches, starters, circuit breakers and contactors: Provide neatly typed label inside each motor starter and contactor enclosure door identifying motor or load served, nameplate horsepower, full load amperes, code letter, service factor, and voltage / phase rating. Provide Phenolic nameplate on cover exterior to indicate motor or load served, location of load served, panel(s) and circuit(s) serving load(s), description and location of control controlling contactor (i.e., contactor controlled by switch in Room A107.), and panel and circuit feeding line side of control transformer.
Example of label for lighting / receptacle contactor: Lighting Contactor
Panel HA 2,4,6
Control circuit – Panel HA 2,4
Location – West parking Lot Pole Lights
Switched – BMCS
- 3. Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit descriptions shall include explicit description and identification of items controlled by each individual breaker, including final graphics room number or name designation and name of each item served. If no building appointed room number or name is given, list locations per the following examples – A. Storage in Rm 100 – B. Office in Rm 100 – C. Storage west of Rm. 100. List corridors as “corridors.” Identify circuits controlled by contactors using a separate notation for each contactor used. List notation at bottom of schedule stating the circuits are controlled by a contactor, list exact location of contactor, and how switched. Do not use architectural room number designation shown on plans. Obtain final graphics room number identification from Architect’s final room number graphics plan. All locations served by breakers shall be listed on schedule. Panel schedule shall be large enough to contain all information required. Also refer to Section 26 24 16.
- 4. Permanent, waterproof, black markers shall be used to identify each lighting and power grid junction box, gutter and wireway. Clearly indicate the panel and branch circuit numbers available at that junction box, gutter or wireway. Where low voltage relay panels are used for lighting control, identify the low voltage relay panel and number in addition to the branch circuit panel and number.
- 5. Pull Boxes, Transformers, Disconnect Switches, etc.: Field work each with a name plate showing identity, voltage and phase and identifying equipment connected to it. The transformer rating shall be shown on the panels or enclosures. For an enclosure containing a motor starter, the nameplate shall include the Owner’s motor number, motor voltage, number of motor phases, motor load being serviced, motor horsepower, and motor full load current. Nameplates shall also indicate where panel is fed from.
- B. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (e.g., Underwriters Laboratories), and approval labels are exceptions to this requirement.
- C. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.
- D. Wire and Cable Markers: Provide vinyl cloth markers with split sleeve or tubing type, except in

manholes provide stainless steel with plastic ties.

- E. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways, contactors, and motor controllers and load connection. Identify with panelboard / switchboard branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's shop drawings for control wiring.
- F. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch-wide plastic tape, colored red or orange with suitable warning legend describing buried electrical lines; telephone lines and data lines. All underground electrical conduits shall be so identified. Tape shall be buried at a depth of six (6) inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground electrical conduits.

3.3 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the electrical systems.
 - 1. Provide the training during regular working day.
 - 2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.
- B. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.
- C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- D. Demonstrate equipment functions (both individually and as part of the total integrated system).
- E. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- F. Submit a report within one week after completion of training. List time and date of each demonstration, time devoted to the demonstration, and a list of people present.
- G. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he / she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- H. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.5 OPENINGS

- A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.6 HOUSEKEEPING PADS

- A. Provide concrete equipment housekeeping pads under all floor and outdoor mounted electrical equipment.
- B. Concrete and reinforcing steel shall be as specified in Division 3, or as indicated or noted.
- C. Concrete pads:
 - 1. Six-inch thick minimum indoors; eight-inch thick minimum outdoors, or thicker if indicated on the drawings or in other sections of the specifications.
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Extend 3-inches minimum indoors beyond perimeter of equipment unless otherwise shown.
 - 5. 6-inch x 6-inch #8 wire reinforcement mesh.

3.7 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
 - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
 - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

3.8 VANDAL RESISTANT DEVICES

- A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used, and 25 percent spare fasteners.
- B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.9 PROTECTION

- A. Protect work, equipment, fixtures, and materials per the manufacturer's requirements. At work completion, work must be clean and in original manufacturer's condition.
- B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.10 OVERCURRENT DEVICE COORDINATION STUDY

- A. Contractor shall provide a coordination study and fault current analysis report, conducted and prepared by the switchgear manufacturer. The coordination study and fault current analysis shall include the manufacturer's recommendations for all adjustable overcurrent devices specified or provided.
- B. Contractor shall adjust all overcurrent device settings based on manufacturer's recommendations, or as directed by Owner / Architect at no additional cost to Owner. Settings for GFI shall be set at maximum as permitted by the NEC.

3.11 TESTING

- A. The contract will not be declared to be substantially complete until the functional operation of the subsystems have been demonstrated and verified and reports have been provided, reviewed and accepted.
- B. The project will not be declared substantially complete until the following has taken place.
 - 1. The "As-Built" drawings have been submitted, reviewed and accepted by the Architect / Owner / Owner's Construction Representative.
 - 2. The various systems and building emergency lighting system have been commissioned and accepted.
 - a. Building Fire Alarm System
 - b. Television Distribution System
 - c. Building Data / Voice Cabling System
 - d. Surveillance and Security System
 - e. Intercom / Telephone
 - f. Building Emergency Lighting System
 - g. Building Lighting Occupancy Sensor Controls
 - h. Surge Protective Device Equipment

END OF SECTION

SECTION 26 05 10

UTILITY COORDINATION AND SERVICE ENTRANCE

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. General: Electrical service shall be provided by local utility company. Provide infrastructure, conduit, duct banks and pathways from public street right-of-way to building for telecommunications and cable service.
- B. Power Company Data: Obtain from utility company information and installation standards for electrical, telecommunication, and cable service installation.
- C. Responsibilities: Determine what equipment and labor is provided by utility company and what equipment and labor is required of this Contractor.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Service Data: Ensure that utility company service data is accurate and verified.

2.2 PRIMARY SERVICE

- A. General: Division 26 shall provide primary service conduit, manholes, and pull boxes as required and as specified for electrical service. Division 26 shall provide grounding rods, grounding conductors, sleeves, conduits, pull boxes and manholes as required by telecommunications and cable service providers.
- B. Electric utility company shall provide primary cables, splices, terminations, and primary underground and overhead service conductors. Telecommunications and cable service utility companies shall provide cabling and connections to the Owner's demarcation point of service.

2.3 SECONDARY SERVICE CABLE TAP BOXES

- A. General: Division 26 shall provide secondary service cable tap boxes as approved by the utility company. Where required or specified, enclosure shall be constructed of NEMA 3R construction.

2.4 SECONDARY SERVICE CONDUCTORS

- A. General: Division 26 shall provide secondary service entrance conductors and conduit.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Standards: The installation of the service entrance provisions shall comply with the published standards and requirements of the utility company, the utility company's specific construction requirements for this project, and with requirements of this Division.
- B. Correction: Any failure to meet the standards and requirements shall be corrected to the satisfaction of the utility company and Owner without any additional cost to the Owner.
- C. Contractor shall provide all construction materials and labor that the utility company determines to be the responsibility of the customer, at no additional cost to the Owner.

- D. The materials and labor required by the for a complete installation shall be provided by the contractor and includes, but is not limited to permanent or removable / lockable vehicular barriers, grounding rods, grounding conductors, sleeves, concrete pads, conduits, metering racks and metering enclosures.
- E. Primary distribution poles and service entrance ductbank locations shall be staked and surveyed prior to pole installation by the Contractor to verify their proper placement is within the Owner's property and respective utility easements. Contractor shall verify by survey that the pole and service entrance ductbank location and easements do not interfere with existing easements, right-of-ways, or other restricted properties. Conflicts with existing easements and restrictions shall be brought to the attention of the Architect prior to construction.
- F. Contractor shall initiate contact with the utility providers and Owner within 14 days of Notice to Proceed to ensure permanent power will be available to the site. Any delays resulting from lack of this coordination shall be the responsibility of the Contractor.

END OF SECTION

SECTION 26 05 18

DWELLING UNIT CABLES, CONNECTORS AND WALL BOXES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide electrical boxes, cables, and connector work as shown, required, and specified.
- B. Conductors and connectors required for the dwelling units include the following:
 - 1. 600V copper non-metallic NM and NMC cables.
 - 2. 600V aluminum or copper service entrance rated SE and USE cables.
 - 3. 600V compression connectors.
- C. Outlet and switch boxes required for the project include the following:
 - 1. Non-metallic PVC or thermoplastic
 - 2. Metallic
- D. Application: The applications for boxes, conductors and connectors required on the project are as follows:
 - 1. Power distribution circuitry within residential dwelling units in walls and spaces not shared with common areas or areas not classified as a dwelling unit.
 - 2. Lighting branch circuitry
 - 3. Appliance, receptacle, and equipment branch circuitry
 - 4. Motor branch circuitry
 - 6. Other line voltage circuits
- E. In walls shared with non-dwelling unit spaces, boxes shall be metallic and MC cable shall be used or conductors shall be in metallic conduit or MC as permitted by the NEC. Refer to other specification sections.
- F. Refer to other specification sections for wiring in common for voice, audio, video, data, alarm and instrumentation cables.

1.2 QUALITY ASSURANCE

- A. UL Label: Cables, connectors, boxes, and accessories shall be listed and approved for their intended use.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CONNECTORS

- A. General: Except as indicated, provide conductors and connectors of manufacturer's standard materials, as indicated by published product information, designed and constructed as instructed by the manufacturer, and as required for the installation.
- B. Conductors: Provide factory-fabricated conductors of the size, rating, material, and type as indicated for each use. Conductors shall be soft or annealed copper wires meeting, before stranding, the requirements of ASTM B 3, Standard Specification for Soft or Annealed Copper Wire for Electrical Purposes, latest edition.
 - 1. Conductors sized #14 AWG through #10 AWG shall be solid or stranded.
 - 2. Conductors size AWG #8 and larger shall be stranded. Stranding shall be Class B meeting the requirements of ASTM B 8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft.
 - 3. Where authorized in writing by the Owner and Architect and not prohibited by local codes or the Authority Having Jurisdiction (AHJ), aluminum compact stranded AL SE or USE cable may be substituted at Contractor's discretion only for service entrance

conductors. Aluminum conductors shall not be used for grounding or for branch circuits or any equipment terminations. Aluminum conductor size shall meet or exceed the equivalent ampacity for the specified copper conductor using dwelling ampacities for both types of conductors.

- C. Insulation for standard building conductors: Insulation shall meet or exceed the requirements of UL 83, Standard for Thermoplastic Insulated Wires.
 - 1. All wiring inside lighting fixtures shall be temperature rated per NEC.
 - 2. Insulation for copper conductors shall be UL Type THHN/THWN, 90 degrees C.
 - 3. Insulation for aluminum SE conductors shall be UL Type XHHW-2, 90 degrees C.
- D. Color coding for conductors as required by NEC. Color coding for phase and voltage shall be as required by local codes and local standards.

2.2 BOXES AND FITTINGS

- A. Interior Outlet Boxes: Provide PVC or thermoplastic outlet wiring boxes, of the type, shape, and size, including depth of box, to suit respective locations and installation. Provide gang boxes where devices are shown grouped. Single box design; sectional boxes are not acceptable.
 - 1. Type of Various Locations:
 - a. Technology, data, voice, video and multi-media outlet boxes: minimum 4-inch square (2-gang), 3-inch deep.
 - b. Security, access control, and video surveillance outlet boxes: single gang outlet boxes mounted long axis vertically, 3-inch deep.
 - c. All other applications: minimum 4-inch square (2-gang) 3-inch deep boxes.
 - d. Surface: Type FS or FD box with surface cover.
 - e. Special: Where above types are not suitable, boxes as required, taking into account space available, appearance, and code requirements.
 - 2. Interior Outlet Box Accessories: Outlet box accessories required as for installation, including covers or wall device plates, mounting brackets, wallboard hangers, extension rings, plaster rings for boxes in plaster construction, fixture studs, cable clamps and metal straps or bar hangers for supporting outlet boxes. Accessories shall be compatible with outlet boxes used and meet requirements of individual wiring.
- B. Damp or wet location outlet and switch boxes: Deep type, cast-metal weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends, and stainless-steel cover plate with spring-hinged waterproof caps suitable for application. Include faceplate gasket.
- C. Junction and Pull Boxes: Galvanized sheet steel junction and pull boxes, with screw-on covers, of type, shape, and size, to suit respective location and installation.
 - 1. Type for Various Locations:
 - a. Minimum Size: 4-inch square, 2-1/8-inches deep.
 - b. 150 Cubic Inches in Volume or Larger: Code gauge steel with sides formed and welded, screw covers unless shown or required to have hinged doors. All boxes mounted above ceiling shall have screw covers. Boxes in all other areas with covers larger than 12-inches shall have hinged with screw covers. Knockouts factory stamped or formed in field with a cutting tool to provide a clean symmetrically cut hole.
 - c. Exterior or Wet Areas: 304 stainless steel NEMA 4X construction with gaskets and corrosion-resistant fasteners
- D. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of type, shape, and size, to suit location and installation. Construct with threaded conduit ends, removable cover, and corrosion-resistant screws.

- E. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts, and insulated conduit bushings of type and size to suit use and installation.
- F. Outlet boxes in fire rated walls: Provide 2-hour rated gasket within box and below cover, equal to Rectorseal Metacaulk box guard and cover guard.

PART 3 - EXECUTION

3.1 CABLE AND CONDUCTOR INSTALLATION

- A. General: Install electrical cable and conductors and connectors as shown, in accordance with the manufacturer's written instructions, the requirements of NEC, the NECA Standard of Installation, and industry practices.
- B. Coordination: Coordinate conductor installation work with electrical raceway and equipment installation work, as necessary for interface.
- C. Cables:
 - 1. Provide a grounded (neutral) conductor for each branch circuit. Do not share grounded (neutral) conductors.
 - 2. Run service entrance cables their entire length in continuous section without joints or splices.
 - 3. No wire smaller than #14 AWG shall be permitted for any 15 Amp circuit. No wire smaller than #12 AWG shall be used for any 20 Amp circuit.
 - 4. Provide the same size wire from the load center to last outlet on circuit.
 - 5. Branch circuit voltage drop shall not exceed 3% of rated voltage.
 - 6. No tap or splice shall be made in any conductor except in outlet boxes, switch boxes, pull boxes, junction boxes, splice boxes. Those boxes shall be in an accessible location. Make taps and splices using an approved connector. Insulate taps and splices equal to the adjoining conductor. Make splices or taps only on conductors that are a component part of a single circuit, protected by approved methods. Taps or splices in feed through branch circuits for connection to light switches or receptacles shall be made by pigtail connection to the device.
 - 7. Support cables to building structure framing as required by NEC.
 - 8. Do not permit conductors entering or leaving a junction or pull box to deflect to create pressure on the conductor insulation.
 - 9. Make joints in branch circuits only where circuits divide. These shall consist of one through circuit to which the branch from the circuit shall be spliced.
 - 10. Make connections in conductors up to a maximum of one #6 AWG wire with two #8 AWG wires using twist-on pressure connectors of required size.
 - 11. Make connections in conductors or combinations of conductors larger than specified using cable fittings of type and size required for specific duty.
 - 12. After a splice is made, insulate entire assembly with UL-approved insulating tape to a value equivalent to the adjacent insulation.
 - 13. Make splices and connections in control circuit conductors using UL-approved solderless crimp connectors.
 - 14. All cables shall include a grounding conductor.
 - 15. Neatly train and lace wiring inside boxes, equipment, and load centers.
 - 16. Clean conductor surfaces before installing lugs and connectors.
 - 17. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 - 18. Provide stranded conductors connected with pressure type connectors / compression fittings and terminal lugs UL listed for the type of conductor used (AL-CU) and correctly sized to the diameter of the bare conductors.
 - 19. Run mains and feeders their entire length in continuous pieces without splices or joints.
 - 20. Color code conductors.
 - 21. Conductors shall be the same color from load side of overcurrent protection device to

- outlet or utilization equipment.
- 22. Spare cables or conductors shall not be installed in any conduit, gutter, raceway, panel, load center, or enclosure unless noted otherwise.
- D. Splices and Joints:
 - 1. In accordance with UL 486A, C, D, E, and NEC.
 - 2. Aboveground Circuits (No. 6 AWG and smaller):
 - a. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F, with integral insulation, approved for copper and aluminum conductors.
 - b. The integral insulator shall have a skirt to completely cover the stripped wires.
 - c. The number, size, and combination of conductors, as listed on the manufacturers' packaging, shall be strictly followed.
- E. Above ground Circuits No. 4 AWG and larger:
 - 1. Connectors shall be indent, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.
 - 2. Provide field-installed compression connectors for cable sizes 250 kcmil and larger with not less than two clamping elements or compression indents per wire.
 - 3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
 - 4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.
- F. Underground Branch Circuits and Feeders:
 - 1. Submersible connectors in accordance with UL 486D, rated 600 V, 190°F, with integral insulation.

3.2 BOXES AND FITTINGS INSTALLATION

- A. Install electrical boxes and fittings as shown and as required, in compliance with NEC requirements, in accordance with the manufacturer's written instructions, in accordance with industry practices. All boxes at finished surfaces shall be recessed to a depth compatible with the finish material without the use of box extenders or field modifications.
- B. Provide minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes for technology, data, audio/video, and multi-media outlet boxes. Provide single gang only, 3-inch deep outlet boxes mounted long axis vertically for security, signaling, access control, and video surveillance, coordinate with communications, security and technology equipment installation. Provide minimum 3-inch deep boxes for all other applications. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation. Box extenders or plaster rings shall not be used to increase size. Provide increased box size as required for the specific installation.
- C. Determine from the drawings and by field measurement the location of each outlet. Locate electrical boxes to accommodate millwork, fixtures, marker boards, and other room equipment at no additional cost to the Owner. The outlet locations shall be modified from those shown to accommodate changes in door swing or to clear interferences that arise from construction as well as modifying them to center in rooms. The modifications shall be made with no cost to the Owner as part of coordination. Check the conditions throughout the job and notify the Architect of discrepancies. Verify modifications before proceeding with installation. Set wall boxes in advance of wall finish construction, blocked in place and secured. Set all wall boxes flush with the finish. Provide wall box support legs, hangers, or other approved accessories attached to studs to prevent movement of box in wall and to hold plumb and square.
- D. Unless noted or directed otherwise at installation, place outlet boxes as indicated on architectural elevations and as required by local codes.

- E. Outlets above counters, mount long axis vertically. Refer to architectural elevations and coordinate to clear backsplash and millwork.
- F. Provide pull boxes, junction boxes, wiring troughs, and cabinets where necessary for installation of electrical systems.
- G. Provide weatherproof boxes for interior and exterior locations exposed to weather or moisture.
- H. Provide knockout closures to cap unused knockout holes in boxes.
- I. Locate boxes and conduit bodies to ensure access to electrical wiring. Provide minimum 12-inch clearance in front of box or conduit body access.
- J. Secure boxes to the substrate where they are mounted or embed boxes in concrete or masonry.
- K. Boxes shall not be secured to the drywall or wall finishes, HVAC ductwork, or piping system.
- L. Provide junction and pull boxes for feeders and branch circuits where shown and where required by NEC, regardless of whether or not boxes are shown.
- M. Coordinate locations of boxes in fire rated partitions and slabs to not affect the fire rating of the partition or slab. Notify the Architect in writing where modification or construction is required to maintain the partition or slab fire rating.
- N. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- O. Use flush mounting outlet box in finished areas unless specifically indicated as being used with exposed conduit.
- P. Locate flush-mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- Q. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches with stud separation. Provide minimum 24 inches with separation in acoustic rated walls.
- R. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Provide UL listed materials to support boxes in walls to prevent movement. Ensure box cannot be pushed inside wall.
- S. Use stamped steel bridges to fasten flush mounting outlet box between studs that can not be directly fastened to the stud.
- T. Install flush mounting box without damaging vapor barriers, wall insulation or reducing its effectiveness.
- U. Use adjustable steel channel fasteners for hung ceiling outlet box.
- V. Use gang box where more than one device is mounted together. Do not use sectional boxes.
- W. Install knockout closures in unused metal box openings.
- X. Mount boxes to the building structure with supporting facilities independent of the conduits or raceways.
- Y. Adjust flush-mounting outlets to make front flush with finished wall material.
- Z. Do not mount junction boxes above in inaccessible spaces. Do not mount junction boxes

above ceilings accessible only by removing light fixture, mechanical equipment or other devices. At inaccessible spaces use junction box furnished with light fixture or light fixture wiring compartment UL listed for through wiring accessible through the fixture housing.

- AA. All boxes shall be protected from building finish painters' over spray and from fire proofing overspray. Remove protective coverings when painting and fire proofing are complete.
- BB. Bond equipment grounding conductor to all metallic junction and pull boxes.
- CC. Box extenders or plaster rings shall not be used to increase the code mandated cable capacity of a box. Provide proper size box.
- DD. Per IECC requirements, boxes which are installed in the thermal envelope of the building shall be sealed to limit air leakage. Install an air barrier behind electrical and communication boxes.

3.4 TESTING

- A. Pre-Energization Check: Before energizing, check cable and conductors for circuit continuity and short circuits. Correct malfunctions.
- B. Service Entrance and Feeder Insulation Resistance Test: Each service entrance conductor and each feeder conductor shall have its insulation resistance tested after the installation is complete except for connection at its source and point of termination. Testing shall be performed by qualified technicians who have been trained in testing procedures and in the use of all test equipment.
 - 1. Make tests using a Biddle Megger or equivalent test instrument at a voltage of not less than 1000 VDC; measure resistance from conductor to conductor, conductor to neutral (if present) and from conductor to ground. Insulation resistance shall not be less than the following:

Wire Size (AWG)	Insulation Resistance (Ohms)	
#8	250 K	
#6 through #2	100 K	
#1 through #4/0	50 K	
Larger than #4/0	25 K	

- 2. Conductors that do not meet or exceed the insulation resistance values listed above shall be removed, replaced, and retested.
- C. Submittals: Contractor shall furnish instruments and personnel required for tests. Submit 4 copies of certified test results to Architect for review. Test reports shall include conductor tested, date and time of test, relative humidity, temperature, and weather conditions.
- D. Voltage and Current Values: The voltage and current in each conductor shall be measured and recorded after connections have been made and the conductor is under load.

END OF SECTION

SECTION 26 05 19

CONDUCTORS AND CONNECTORS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide electrical conductors, wire and connector work as shown, and specified.
- B. Types: The types of conductors and connectors required for the project include the following:
 - 1. 600V building conductors
 - 2. 600V building conductor connectors
- C. Application: The applications for conductors and connectors required on the project are as follows:
 - 1. Power distribution circuitry
 - 2. Lighting branch circuitry
 - 3. Appliance, receptacle, and equipment branch circuitry
 - 4. Motor branch circuitry
 - 5. Control wiring
 - 6. Line voltage
- D. Refer to other specific specification sections for voice, video, data, alarm and instrumentation cables.

1.2 QUALITY ASSURANCE

- A. UL Label: Conductors and connectors shall be UL labeled.

1.3 REFERENCES

- A. Refer to other specific specification sections regarding specialized wiring and connections.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CONNECTORS

- A. General: Except as indicated, provide conductors and connectors of manufacturer's standard materials, as indicated by published product information, designed and constructed as instructed by the manufacturer, and as required for the installation.
- B. Conductors: Provide factory-fabricated conductors of the size, rating, material, and type as indicated for each use. Conductors shall be soft or annealed copper wires meeting, before stranding, the requirements of ASTM B 3, Standard Specification for Soft or Annealed Copper Wire for Electrical Purposes, latest edition.
 - 1. Conductors for control wiring sized #14 AWG through #10 AWG shall be stranded.
 - 2. Conductors for power and lighting shall be stranded. Stranding shall be Class B meeting the requirements of ASTM B 8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft.
- C. Insulation for standard building conductors: Insulation shall meet or exceed the requirements of UL 83, Standard for Thermoplastic Insulated Wires.
 - 1. All wiring inside lighting fixtures shall be temperature rated per NEC.
 - 2. Insulation for copper conductors shall be UL Type THHN/THWN, 90 degrees C.

2.2 COLOR CODES FOR CONDUCTORS FOR BRANCH CIRCUITS AND FEEDERS

- A. Provide color coding for conductors as required by NEC 210.5. Color coding for phase and

voltage shall be as required by local codes and standards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install electrical conductors and connectors as shown, in accordance with the manufacturer's written instructions, the requirements of NEC, the NECA Standard of Installation, and industry practices.
- B. Coordination: Coordinate conductor installation work with electrical raceway and equipment installation work, as necessary for interface.
- C. Conductors:
 1. Provide a grounded (neutral) conductor for each branch circuit. Do not share grounded (neutral) conductors.
 2. No more than six phase conductors shall be installed in a single raceway.
 3. When any combination of four or more phase and grounded (neutral) conductors are installed in a raceway, the minimum size for all conductors including equipment ground conductor shall be #10 AWG, and they shall be de-rated accordingly.
 4. Any combination of phase conductors and grounded (neutral) conductors in any raceway shall not exceed nine.
 5. When more than three (3) conductors are size #10 AWG, they shall be installed in a one-inch conduit.
 6. Pull conductors together when more than one is being installed in a raceway. Whenever possible, pull conductors into their respective conduits by hand. Use pulling lubricant when necessary.
 7. No wire smaller than #12 AWG shall be permitted for any lighting or power circuit. No wire smaller than #14 AWG shall be used for any control circuit, unless shown otherwise.
 8. For 15 and 20 amp branch circuits operating at 150V or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating at 150 to 600 volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
 9. Neatly train and lace wiring inside boxes, equipment and panelboards. Provide tie-straps around conductors with their shared neutral conductor where there are more than two neutral conductors in a conduit.
 10. Do not install a pull string in conduits containing conductors.
- D. Identification: Label each phase conductor in each junction box with corresponding circuit number, using self-adhesive wire markers.
- E. Splices and Joints:
 1. In accordance with UL 486A, C, D, E, and NEC.
 2. Aboveground Circuits (No. 10 AWG and smaller):
 - a. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F, with integral insulation, approved for copper and aluminum conductors.
 - b. The integral insulator shall have a skirt to completely cover the stripped wires.
 - c. The number, size, and combination of conductors, as listed on the manufacturers' packaging, shall be strictly followed.
- F. Aboveground Circuits (No. 8 AWG and larger):
 1. Connectors shall be indent, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.
 2. Provide field-installed compression connectors for cable sizes 250 kcmil and larger with not less than two clamping elements or compression indents per wire.

3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
 4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.
- G. Underground Branch Circuits and Feeders:
1. Submersible connectors in accordance with UL 486D, rated 600 V, 190°F, with integral insulation.

3.2 TESTING

- A. Pre-Energization Check: Before energizing, check cable and conductors for circuit continuity and short circuits. Correct malfunctions.

END OF SECTION

SECTION 26 05 26

ELECTRICAL GROUNDING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Grounding shall conform to the requirements of:
 - 1. National Electrical Code.
 - 2. Governing local codes.
 - 3. All Local Utility Companies
- B. Ground effectively and permanently.
 - 1. Neutral conductor at the main service disconnect and other separately derived systems.
 - 2. All conduit systems.
 - 3. All electrical equipment and related current carrying supports or structures.
 - 4. All metal piping systems.
 - 5. All building structural metal frames.
 - 6. All telephone/voice/video/CATV/data utilities

1.2 REFERENCE STANDARDS

- A. ANSI/IEEE Standard 142 - "Recommended Practice for Grounding of Industrial and Commercial Power Systems."
- B. ANSI/UL 467 - "Safety Standard for Grounding and Bonding Equipment."
- C. Article 250 of the NEC (NFPA 70) for grounding.
- D. NECA – Standard of Installation
- E. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- F. EIA / TIA 607

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Copperweld
- B. Cadweld
- C. Burndy
- D. O. Z Gedney

2.2 GROUNDING ELECTRODES

- A. Driven Rod Electrode: UL Listed, 3/4" x 10'-0" copper clad grounding electrode.
- B. Metal Frame of Building.
- C. Foundation concrete encased rebar.

2.3 DATA / VOICE COMMUNICATIONS CLOSET GROUND BAR

- A. Heavy-duty, two bolt type, copper alloy or bronze for grounding and bonding applications, in configurations required for particular installation.

2.4 WIRE

- A. Stranded, copper cable
- B. Foundation Electrodes: 4/0 AWG
- C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements

PART 3 - EXECUTION

3.1 GROUNDING AND BONDING

- A. In the service equipment, provide a separate (dedicated) ground bus.
 - 1. Bond the ground bus with copper bus bar or cable, of equal or greater current carrying capacity of the service grounding conductor, to the neutral bar.
 - 2. Resistance of neutral to ground shall not exceed 10 Ohms.
 - 3. Connect the electric service grounding electrode conductors to the incoming metal water pipe system (when available, using a suitable ground clamp) and to a supplemental electrode such as a ground rod or ground loop.
 - 4. Provide grounding and bonding at the power company's metering equipment.
 - 5. Provide access and cover for access to the ground grid and removable connections for testing the system.
- B. Connect the grounding electrode conductor between the ground bus and the grounding electrode system.
 - 1. In rigid PVC conduit.
 - 2. Provide connection for each rod ground electrode.
 - a. All rod electrodes shall be located outside the building in non-paved areas where available. Access cover top shall be flush with finish grade or floor.
 - b. Install rod electrodes as indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
 - c. The minimum distance between driven ground rod electrodes shall be 10'.
 - 3. The total ground resistance shall not exceed 10 Ohms for service entrance grounds and 25 Ohms for equipment grounds.
 - a. Where this condition cannot be obtained with one electrode, install a longer electrode, deep-driven sectional electrodes, or additional grounding electrodes until the required ground resistance is obtained.
- C. Provide an insulated equipment grounding conductor inside all conduits, raceways, surface raceways, gutters and wireways. The ground wire shall be bonded to each box to suitable lug, bus, or bushing. All bonding jumpers shall be routed inside conduit or raceway.
- D. Provide all conduit terminating in transformers, panelboards and voice/data outlets with grounding bushings, where required and ground wire extended to ground bus in equipment.

3.2 METAL FRAME OF BUILDING OR STRUCTURE

- A. Effectively ground the building steel or structure per NEC 250-52 (2).

3.3 UFER GROUND

- A. Provide a UFER ground at bottom of building slab per NEC 250.52 (3), bond to building steel.

3.4 MISCELLANEOUS REQUIREMENTS

- A. Continuity of the building equipment grounding system shall be maintained throughout the project. Equipment grounding jumpers shall be installed across conduit expansion fittings, liquid-tight flexible metal and flexible metal conduit, light fixture pigtails in excess of 6', and other non-electrically continuous raceway fittings.
 - B. Equipment grounding conductors and grounding electrode conductor shall be stranded copper conductors and run in a suitable raceway. Grounding conductors and grounding electrode conductor shall be continuous, without joints or splices over their entire length, except as allowed by NFPA 70/NEC.
 - C. For separately derived alternating current system grounds, bond the case and neutral of each transformer secondary winding directly to the nearest available effectively grounded structural metal member as required in NEC 250.
 - D. Technology/Data/Voice Communications, CATV, CCTV, and MATV Equipment Grounding: Provide grounding electrode conductor from the communications service equipment to the building grounding system as required. Provide #6 ground conductor from telephone/voice/CATV/data company demarcation point to building electrical service entrance ground electrode connection and as required by all local utility companies.
 - E. Ground lighting fixture bodies to the conduit grounding system.
 - F. Receptacles shall require a ground wire bonded to the conduit ground system, except where and insulated/isolated grounding receptacle or outlet is specified.
 - G. Motor Frames: Ground the frame of each motor with a properly sized separate ground wire inside flexible conduit.
 - H. Ground each panelboard by connecting the grounding conductors to the grounding stud.
 - I. Bond every item of equipment served by the electrical system to the building equipment ground system. This includes panelboards, disconnect switches, receptacles, fans, air handling units, pumps and flexible duct connections.
 - J. Ground each light pole and metal conduit stub-ups at each light pole base.
 - K. Ground all metal conduit including metal conduit used for bends and penetrations through concrete.
- 3.5 ELECTRICAL SWITCHGEAR NOT INTENDED NOR UL LISTED AS SERVICE ENTRANCE RATED
- A. Remove all factory installed grounding screws, straps or studs identified for neutral to ground bonding.
 - B. Do not convert neutral bus to ground bus.

END OF SECTION

SECTION 26 05 33

CONDUIT SYSTEMS AND MC CABLE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a complete system of electrical conduits and fittings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Raceways and Fittings unless otherwise indicated:
 - 1. Allied
 - 2. International Metal Hose
 - 3. Ipex
 - 4. Heritage Plastics
 - 5. Wheatland
 - 6. Can-Tex
 - 7. North American Pipe
 - 8. Anamet, Inc.
 - 9. Electri-Flex Co.
 - 10. Western Tube and Conduit
- B. Stainless Steel Conduit and Fittings:
 - 1. Calbrite
 - 2. Gibson
- C. Aluminum Conduit and Fittings:
 - 1. American Conduit/Sapa
 - 2. Wheatland
 - 3. Patriot Aluminum Products
- D. Condulets and Conduit Bodies unless otherwise indicated:
 - 1. Appleton
 - 2. Form 85
- E. Stainless Steel Condulets and Conduit Bodies:
 - 1. Calbrite
 - 2. Gibson
 - 3. Crouse Hinds
- F. MC Cable
 - 1. AFC
 - 2. Southwire
 - 3. General Cable
 - 4. Kaf-Tech

2.2 PROHIBITED PRODUCTS

- A. Prohibited Products
 - 1. BX cable
 - 2. AC cable
 - 3. Electrical nonmetallic tubing (ENT)
 - 4. Flexible polyethylene or PVC tubing

5. Intermediate Metal Conduit (IMC)

2.3 RIGID METAL CONDUIT (RMC)

- A. Schedule 40 conduit and fittings:
 - 1. Galvanized Conduit - Mild steel pipe, Zinc coated inside and out
 - 2. Aluminum Conduit - Aluminum Alloy 6063, T-1 temper
 - 3. Threaded ends and fittings
 - 4. Insulated bushings

2.4 ELECTRICAL METALLIC TUBING (EMT)

- A. Metallic Tubing
 - 1. Zinc Coated Steel - Cold rolled steel tubing, Zinc coated inside and out
 - 2. Aluminum - Aluminum Alloy 6005, 6063. Temper T-1
- B. Fittings shall meet the same requirements as EMT conduits.
 - 1. Full Compression Fittings
 - 2. Insulated throat connectors
- C. Prohibited Products
 - 1. Cast metal fittings
 - 2. Uni-couple type connectors
 - 3. Split ring, anti-short bushings

2.5 FLEXIBLE CONDUIT

- A. Steel flexible metallic conduit:
 - 1. Zinc coated inside and out
 - 2. 18-inches minimum length, 24-inches maximum length
 - 3. 18 inches minimum length; 6 feet maximum length for light fixture whips only
- B. Liquid tight flexible steel conduit
 - 1. Type L.A. - Grounded
 - 2. 18-inches minimum length, 24-inches maximum length

2.6 PVC CONDUIT

- A. Schedule 40 and Schedule 80
- B. PVC fittings and solvent welded joints
- C. PVC elbows and fittings, except for threaded/slip-on/glue or straight conduit slip-on / glue fittings, shall not be used on this project.

2.7 CONDULETS AND CONDUIT BODIES

- A. Form 85
- B. PVC Coated: Form 8
- C. LBC Condulets shall be used for size 2 inch and above. LL and LR Condulets shall not be used for 2 inch and above

2.8 ROOF MOUNTED CONDUIT AND BOX SUPPORTS

- A. Refer to roofing specifications for additional information. The limitations and restrictions contained in any roofing specification shall prevail and supercede these specifications for roof

mounted supports for conduits and boxes.

- B. Acceptable Manufacturer:
 - 1. Portable Pipe Hangers
 - 2. Cooper B-Line C-Port
 - 3. Miro Industries Models 2.5, 2.5-5, 2.5-AH, 12-AH, 16-AH

2.9 STAINLESS STEEL CONDUIT

- A. Rigid Conduit, Fittings and Supports:
 - 1. Type 304 Stainless Steel
 - 2. Threaded ends
 - 3. Insulated Bushings
- B. EMT, fittings and Supports:
 - 1. Type 304 Stainless Steel
 - 2. Compression Fittings
 - 3. Insulated Bushings

2.10 METAL CLAD (MC) CABLE

- A. Minimum conductor size shall be #12 AWG. All conductors sized #8 and larger shall be stranded copper.
- B. All MC Cable shall have an insulated ground conductor.
- C. Armor: An aluminum or zinc coated galvanized steel armor shall be applied over the cabled wire assembly with an interlock in compliance with Section 13 of UL 1569.
- D. Fittings shall be UL listed and identified as MCI-A for such use with metal clad interlocking armor ground. Connectors shall be of steel or malleable iron and shall have saddle clamp to insure a tight termination of MC or MCI-A Cable to box.

2.11 EXTERIOR IN-GRADE PULL BOXES

- A. Hubbell CDR 30x48 inch minimum, provide larger size as required by conduit size or quantity:
 - 1. Tier 22 rated traffic duty
 - 2. Conduit entry knock-outs as required
 - 3. Bolt down cover
 - 4. Integral or separate bottom
 - 5. Adjust to grade option
 - 6. Extension as required for specified conduit depth

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install electrical conduits and fittings for all wiring of any type unless otherwise indicated.
- B. Minimum Size Conduit:
 - 1. 0.5-inch unless otherwise indicated
 - 2. (2) 1-inch for low voltage systems unless otherwise indicated
 - 3. 2-inch between buildings unless otherwise indicated
- C. Provide separate raceway systems for each of the following when specified, indicated or required:
 - 1. 120/208 volt circuits

2. Emergency
 3. Voice/Data
 4. Dimming Controls
 5. CATV
 6. Security CCTV
 7. Security System
 8. Communications / PA Systems / Sound System Line Input and Speakers
 9. Fire Alarm
 10. Lighting and Building Management Control Systems
- D. Maintain 13-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- E. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- F. Use conduit hubs to fasten conduit to sides and tops of electrical equipment, device, box, gutter, wireway, disconnect, etc. in damp and wet locations.
- G. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- H. Do not use no-thread couplings and connectors for galvanized steel or aluminum rigid conduit.
- I. In areas where raceway systems are exposed and acoustical or thermal insulating material is to be installed on walls, partitions, and ceilings, raceways shall be blocked out proper distance to allow insulating material to pass without cutting or fitting. Also provide Kindorf galvanized steel channels to serve as standoffs for panels, cabinets and gutters.
- J. All conduit terminations at locations including but not limited to, switchgear, pull boxes, outlet boxes, stub-up, and stub-outs:
1. Insulated throat connectors for EMT conduits.
 2. Insulated bushing on all rigid conduit terminations.
 3. Locknuts inside and outside of all boxes and enclosures.
 4. Threaded type plastic bushing at all boxes and enclosures.
- K. All boxes are to be accessible after completion of construction.
- L. All conduits must be kept dry and free of water or debris with approved pipe plugs or caps. Cap or plug conduit ends prior to concrete pours.
- M. Install expansion and deflection fittings and bonding jumpers on straight runs which exceed 200-feet, on center, and at 200-feet maximum, on center, on straight runs which exceed 400-feet, and where conduits cross building expansion joints.
- N. Provide grounding bushings at concentric/eccentric knockouts or where reducing washers are used.
- O. Install conduit as a complete system, without conductors, continuous from outlet to outlet and from fitting to fitting.
- P. Make up threaded joints of conduit carefully in a manner to ensure a tight joint.
- Q. Conduit bends shall be factory elbows or shall be bent using equipment specifically designed to bend conduit of the type used to maintain the conduit's UL listing.
- R. Provide chrome or nickel-plated escutcheon plates on conduit passing through walls and ceilings in finished areas.
- S. Install one 2-inch diameter conduit nipple between multi-sectional panels independent of feeder conductors.
- T. Prohibited Installations unless noted otherwise
- U. Do not route on floors, paved areas or grade.
- V. Do not Obstruct Equipment Manufacturer's Recommended Service Space or access to that

location

- W. Where aluminum alloy conductors are specified, approved and substituted for copper conductors, provide the required conduit size based on conduit fill using NEC or recognized cable manufacturer's conduit fill tables for aluminum alloy compact conductors.

3.2 INTERIOR ABOVE GRADE INSTALLATION

- A. Conduit Types
1. Concealed Locations:
 - a. EMT
 - b. MC Cable
 2. Exposed conduits in Equipment Rooms:
 - a. EMT
 - b. RGC when installed below 18-inches above finished floor.
 3. Exposed conduits:
 - a. RGC:
 - i. Below 9-feet AFF
 - b. Aluminum rigid conduit
 4. Wet Location
 - a. Aluminum rigid conduit
 5. Damp Location
 - a. Aluminum rigid conduit
 6. Conduit in concrete walls, floor or roof slab:
 - a. RGC
 7. Conduit elbows and rises through the slab or foundation
 - a. RGC
- B. Maintain head room and present neat appearance.
- C. Minimum 6-inches clear of bottom of roof deck.
- D. Perpendicular or parallel to building lines.
- E. Where a piece of equipment is connected from a switch or box on adjacent wall, the conduit shall go up the wall from the box, across, and back down to the equipment.
- F. Conceal conduit systems in finished areas.
- G. Conduit may be exposed in exposed mechanical and electrical rooms or where otherwise indicated.
- H. Prohibited Installations
1. Do not block walkways

3.3 LIGHT FIXTURE WHIPS

- A. Flexible conduit or MC cable used for lighting fixture connection shall be supported from the structure with #13 AWG galvanized iron wire pendants and "Caddy clips".
- B. Each light fixture shall have its own fixture whip from junction box.
- C. Light Fixtures installed end to end or recessed in non-accessible ceilings may connected use chase nipples.
- D. Prohibited installation:
1. Do not install "Daisy Chain" light fixtures installed above accessible ceilings.

3.4 BELOW GRADE INSTALLATION

- A. Conduit Type:
 - 1. PVC
 - 2. Rigid Galvanized Conduit (RGC) for transitional bends and rises from underground PVC conduit up to 18" above grade when passing through a slab or foundation, or when subject to physical damage
- B. Unless shown otherwise, do not install conduit in or below concrete building slabs.
- C. Conduit for all floor boxes shall be routed below building slab from floor box to nearest column, wall, or as indicated.
- D. Changes in direction of underground conduit runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet and a maximum arc of 22.5 degrees.
- E. Provide conduit spacers for parallel branch/feeder conduits. Use suitable manufactured separators and chairs installed 4 feet on centers. Securely anchor conduit at each chair to prevent movement during concrete placement.
- F. Conduit below building slab shall be installed minimum 18-inches below finished floor and in select fill.
- G. Electrical feeder conduits, telecommunications tie, trunk, or service cable conduits shall be installed minimum 48-inches below finished floor and in select fill.
- H. Electrical service primary shall comply with the respective utility company requirements and standards.
- I. Provide two "caution" plastic tapes at 6-inches and 18-inches below finished slab, grade, or pavement.
- J. Conduits located outside building, provide magnetic locator tape at top of first compacted layer of backfill.
- K. As each section of the underground conduit is completed, a testing mandrel with diameter ¼-inch smaller than the conduit, shall be drawn through each conduit. A brush with stiff bristles shall be drawn through until conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.
- L. Verify location and routing of all new and existing underground utilities with the Owner and Architect on the job site. Stake out these existing utilities so that they will not be damaged. Stake out new utilities to provide coordination with other trades and with new and existing utilities, easements, property lines, restricted land use areas, and right-of-ways.
- M. Conduit for 120V and above shall be separated from control and signal conduits by a minimum of 3-inches.
- N. Prohibited Installation.
 - 1. Unless shown otherwise, do not install conduit horizontally in concrete slabs.

3.5 EXTERIOR ABOVE GRADE INSTALLATION

- A. Conduit Type:
 - 1. Aluminum Rigid Conduit
 - 2. RGC where subject to physical damage or where located less than four feet above finished floor, grade or pavement.
- B. Conduit for mechanical / plumbing equipment shall be routed with the associated mechanical / plumbing pipe support rack system where practical, coordinate with Divisions 22 and 23.

3.6 ABOVE ROOF INSTALLATION AND ROOF PENETRATION

- A. Where specifically indicated to be routed or mounted on the roof, installation shall be as specified, recommended by roofing manufacturer, recommended by roof support manufacturer and as required by NEC.
- B. Roof penetrations shall be made in adequate time to allow the roofing installer to make proper flashing.
- C. Conduit for equipment mounted on roof curbs shall be routed through the roof curb.
- D. Prohibited Installations:
 - 1. Conduit, gutters, pull boxes, junction boxes, etc. shall not be routed on roof unless specified otherwise.
 - 2. Do not install conduit, junction boxes, etc. within 18 inches of outside edges of roof access openings.

3.7 CLASSIFIED HAZARDOUS LOCATION CONDUIT AND FITTINGS INSTALLATION

- A. UL listed for the hazard classification
- B. Underground conduit shall be as specified in this section.

3.8 CONDUIT SUPPORTS

- A. Fasten conduit supports to building structure and surfaces;
- B. Support with malleable iron conduit clamps or on conduit racks at intervals as required by NEC
- C. Support conduit on galvanized channel, using compatible galvanized fittings (bolts, beam clamps, and similar items), and galvanized threaded rod pendants at each end of channel and secure raceway to channel and channel to structure. Channel supports shall have cut ends filed smooth
- D. Where rod pendants are not used, channel supports are to be secured to structure at each end.
- E. Conduit supports are to be secured to structure using washers, lock washers, nuts and bolts or rod pendants; use of toggle bolt “wings” are not acceptable.
- F. Support single conduit runs using a properly sized galvanized conduit hanger.
- G. Group related conduit on conduit rack. Construct rack using steel channel; provide space on each rack for 25 percent additional conduits.
- H. Connections to joists shall be made with galvanized channel extended between joist chords or with galvanized channel bearing on the vertical legs of joist chord angles.
- I. Conduits installed in public areas, not concealed by architectural ceilings, shall be supported by galvanized steel channel racks. Coordinate routing with Architect / Owner.
- J. Provide electrical insulating sleeve or wrapping for aluminum conduit supported by zinc coated supports or fasteners.
- K. Galvanized Surfaces: Clean welds, bolted connections, cuts, and abraded areas and apply ZRC galvanized paint or equivalent.
- L. Terminate all motor connection conduits in mechanical room spaces with a floor pedestal and with “Tee” conduit at motor outlet height for flexible conduit.

- M. Where conduit is not embedded in concrete or masonry, conduit shall be firmly secured by approved clamps, half-straps or hangers.
- N. No more than 12 conduits containing branch circuits may be installed in junction boxes, pull boxes or gutters.
- O. Anchors:
 - 1. Rawl Plugs or approved equal anchors.
 - 2. Lead cinch anchors or pressed anchors.
- P. Hardware:
 - 1. Indoors: cadmium plated unless noted otherwise
 - 2. Exterior: Galvanized unless noted otherwise
- Q. Prohibited Installation.
 - 1. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
 - 2. Do not support conduit from conduit, ceiling support wires, roof deck, structural bridging
 - 3. Plastic anchors and lead anchors shall not be used for overhead applications.
 - 4. Beam clamp attachments to steel joist chords
 - 5. Do not support more than one conduit from a single all-thread rod support.
 - 6. Do not utilize Tie wire or short pieces of conduit as supports or hangers.
- R. Acceptable Manufacturer's
 - 1. Kindorf,
 - 2. Unistrut,
 - 3. Superstrut,
 - 4. Caddy,
 - 5. Minerallac

3.10 CONDUIT PENETRATIONS, SLEEVES AND ESCUTCHEONS

- A. Furnish sleeves for placing in construction for all conduit passing through concrete or masonry walls, partitions, beams, grade level other than floor, and roofs. A conduit sleeve shall be one size larger than the size of conduit, which it serves except where larger sizes are required for manufactured water, fire, or smoke stop fittings.
 - 1. Sleeves set in concrete floor construction shall be minimum Schedule 40 galvanized steel.
 - 2. Sleeves shall extend 3-inches above the finished floor.
- B. Sleeves in concrete or masonry walls shall be Schedule 40 galvanized steel. Sleeves shall be set flush with finished wall.
- C. Install manufactured UL listed water, fire, and smoke stop fittings, or caulk around conduit or cables in sleeves with sufficient UL listed fire safe insulation or foam to maintain wall or floor slab fire or smoke rating. Refer to Architecture drawings for locations of rated walls.
- D. Provide Linkseal Mechanical Seals around conduit penetrations through walls below grade. Provide a pull box to serve as a water stop inside wall penetration. Internally seal low voltage cabling conduit penetrations with waterproof caulking.
- E. Sleeves penetrating walls below grade shall be Schedule 40 black steel pipe with ¼-inch thick steel plate secured to the pipe with continuous fillet weld. The plate shall be located in the middle of the wall and shall be 2-inches wider all around than the sleeve that it encircles. The sleeve should extend a minimum of 24-inches on either side of the penetration. The entire

assembly shall be hot-dipped galvanized after fabrication. Do not sleeve or penetrate grade beams.

- F. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with a threaded steel bushing. Route conduit through roof openings, for piping and ductwork or through suitable roof jack, with pitch pocket. Coordinate location with roofing installation as required.
- G. Conduit passing through fire rated wall shall be sealed with Fire Stop. Route conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Division 7.

3.11 PVC CONDUIT AND FITTINGS INSTALLATION

- A. Where 3-1/2-inch conduit is specified and the required or specified material is Schedule 80 PVC, provide 4-inch conduit.

3.12 FLEXIBLE METAL AND LIQUID TIGHT FLEXIBLE METAL CONDUIT AND FITTINGS INSTALLATION

- A. Liquid Tight Flexible Metal Conduit shall only be used for connections to equipment mounted on roof, rotating equipment, transformers, and kitchen or food processing equipment, or where flexible conduit is required outdoors.
- B. Liquid tight flexible metal conduit may be 0.5-inch for roof top supply / exhaust fans only
- C. Flexible metal conduit and liquid tight flexible metal conduit shall only be used for final connections from junction box to equipment, light fixtures, power poles, etc.
- D. Prohibited Installation:
 - 1. Do not use for exterior wall or roof penetrations unless sleeved utilizing PVC coated RGC conduit at least one size larger than the outside diameter of the flexible conduit.

3.13 EXTERIOR IN-GRADE PULL BOXES

- A. Provide pull boxes where specified and as required.
- B. Pull boxes located in pavement shall be set with proper extensions so that top of cover is flush with pavement.
- C. Pull boxes located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.

3.14 IDENTIFICATION

- A. Conduit Systems: Provide adequate marking of conduit larger than one inch exposed or concealed in interior accessible spaces to distinguish each run as either a power (120/208V) or signal / communication conduit (Fire Alarm, Security, CCTV, Access Control, Intrusion Detection, Telecom, etc.). Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Locate markers at ends of conduit runs, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors or enters non-accessible construction, and at spacing of not more than 50-feet along each run of exposed conduit. Switch-leg conduit and short branches for power connections need not be marked, except where conduit is larger than 1-inch.

END OF SECTION

SECTION 26 05 37

ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide electrical box and fitting work as required, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

- A. UL Label: Electrical boxes and fittings shall be UL labeled.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS

- A. Interior Outlet Boxes: Provide galvanized steel interior outlet wiring boxes, of the type, shape, and size, including depth of box, to suit respective locations and installation. Construct with stamped knockouts in back and sides. Provide gang boxes where devices are shown grouped. Single box design; sectional boxes are not acceptable, except for wall mounted electronic displays.
 - 1. Type of Various Locations:
 - a. Wall mounted video displays, televisions, electronic signage and similar installations; recessed wall mounted box for power and/or multi-media (low voltage) outlets: Arlington Industries #TVBS 613 or equal, 4-gang steel box with white trim plate.
 - b. Technology, data, voice, video and multi-media outlet boxes at locations other than wall mounted video displays, televisions, electronic signage and similar installations: minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes.
 - c. Security, access control, and video surveillance outlet boxes: single gang, 3-inch deep outlet boxes mounted long axis vertically.
 - d. All other applications: minimum 4-inch square (2-gang) 2-1/8-inch deep boxes.
 - 2. Interior Outlet Box Accessories: Outlet box accessories required as for installation, including covers or wall device plates, mounting brackets, wallboard hangers, extension rings, plaster rings for boxes in plaster construction, fixture studs, cable clamps and metal straps for supporting outlet boxes. Accessories shall be compatible with outlet boxes used and meet requirements of individual wiring.
- B. Damp Location Outlet and Damp or Wet Location Switch Boxes: Deep type, hot dipped galvanized cast-metal weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends, and stainless steel cover plate with spring-hinged waterproof caps suitable for application. Include faceplate gasket and corrosion-resistant, tamper / vandal proof fasteners.
- C. Wet Location Outlet Boxes: Hot dipped galvanized cast-iron weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends.
- D. Junction and Pull Boxes: Galvanized sheet steel junction and pull boxes, with screw-on covers, of type, shape, and size, to suit respective location and installation.
 - 1. Type for Various Locations:
 - a. Minimum Size: 4-inch square, 2-1/8-inches deep.
 - b. 150 Cubic Inches in Volume or Larger: Code gauge steel with sides formed and welded, screw covers unless shown or required to have hinged doors. All boxes mounted above ceiling shall have screw covers. Boxes in all other areas with covers larger than 12-inches shall have hinged with screw covers.

- Knockouts factory stamped or formed in field with a cutting tool to provide a clean symmetrically cut hole.
 - c. Exterior or Wet Areas: 304 stainless steel NEMA 3R construction with gaskets and corrosion-resistant fasteners
 - E. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of type, shape, and size, to suit location and installation. Construct with threaded conduit ends, removable cover, and corrosion-resistant screws.
 - F. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts, and insulated conduit bushings of type and size to suit use and installation.
 - G. Outlet boxes in fire rated walls: Provide 2-hour rated gasket within box and below cover, equal to Rectorseal Metacaulk box guard and cover guard.

2.2 FLOOR BOXES - CONCEALED SERVICE

- A. Construction shall be as required by UL 514A.
- B. Carpet frame shall be nylon UL Recognized Component QMFZ2.
- C. Hinged outer cover shall be reinforced with a 5/32" steel plate.
- D. Shall deliver electric power from duplex receptacles installed below the surface of the floor.
- E. Shall deliver telephone or data cable without interference from the electric power delivery
- F. Shall protect delivery of both services by a hinged cover with a retractable opening and foam plastic dust seal
- G. When hinged cover is closed and no services in place, device shall have no obstructions above surface of floor.

PART 3 - EXECUTION

3.1 INSTALLATION OF BOXES AND FITTINGS

- A. Install electrical boxes and fittings as shown and as required, in compliance with NEC requirements, in accordance with the manufacturer's written instructions, in accordance with industry practices.
- B. Provide recessed device boxes for wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations.
- C. Junction and pull boxes, condulets, gutters, located above grid ceilings shall be mounted within 18-inches of ceiling grid. Junction and pull boxes above grid ceilings shall be mounted in the same room served. Junction boxes and pull boxes required for areas with inaccessible ceilings shall be located above the nearest accessible ceiling area. All junction box or pull box openings shall be side or bottom accessible. Removal of light fixtures, mechanical equipment or other devices shall not be required to access boxes.
- D. Determine from the drawings and by measurement the location of each outlet. Locate electrical boxes to accommodate millwork, fixtures, marker boards, and other room equipment at no additional cost to the Owner. The outlet locations shall be modified from those shown to accommodate changes in door swing or to clear interferences that arise from construction as well as modifying them to center in rooms. The modifications shall be made with no cost as part of coordination. Check the conditions throughout the job and notify the Architect of discrepancies. Verify modifications before proceeding with installation. Set wall boxes in advance of wall construction, blocked in place and secured. Set all wall boxes flush with the

finish and install extension rings as required extending boxes to the finished surfaces of special furring or wall finishes. Provide wall box support legs attached to stud to prevent movement of box in wall.

- E. Unless noted or directed otherwise at installation, place outlet boxes as indicated on architectural elevations and as required by local codes.
- F. Outlets above counters, mount long axis horizontally. Refer to architectural elevations and coordinate to clear backsplash and millwork.
- G. Provide pull boxes, junction boxes, wiring troughs, and cabinets where necessary for installation of electrical systems. Surface mounted boxes below 9 feet and accessible to the public shall not have stamped knockouts.
- H. Provide weatherproof boxes for interior and exterior locations exposed to weather or moisture.
- I. Provide knockout closures to cap unused knockout holes in boxes.
- J. Locate boxes and conduit bodies to ensure access to electrical wiring. Provide minimum 12-inch clearance in front of box or conduit body access.
- K. Secure boxes to the substrate where they are mounted, or embed boxes in concrete or masonry.
- L. Boxes for any conduit system shall not be secured to the ceiling system, HVAC ductwork or piping system.
- M. Provide junction and pull boxes for feeders and branch circuits where shown and where required by NEC, regardless of whether or not boxes are shown.
- N. Coordinate locations of boxes in fire rated partitions and slabs to not affect the fire rating of the partition or slab. Notify the Architect in writing where modification or construction is required to maintain the partition or slab fire rating.
- O. All box covers shall be labeled with Panel ID and circuit numbers of all circuits available in box using permanent black marker. Boxes containing main feeders are to list where fed from and load (example "MSB to Panel HA"). Information listed is to be legible, markovers are not acceptable. Multi-sectional panel numbers are not to be listed on covers (example "LA2" referring to Panel LA sec. 2 is to be listed as "LA"). Label covers for special applications explaining contents (example "Emerg. Gen. Annunciator controls", "IDF ground"). Do not attach box covers that have both sides painted or labeled differently. In public areas where boxes are painted same color as room per architect, label inside covers.
- P. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- Q. Use flush mounting outlet box in finished areas unless specifically indicated as being used with exposed conduit.
- R. Locate flush-mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- S. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches with stud separation. Provide minimum 24 inches with separation in acoustic rated walls.
- T. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Provide UL listed materials to support boxes in walls to prevent movement. Ensure box cannot be pushed inside wall.
- U. Use stamped steel bridges to fasten flush mounting outlet box between studs.

- V. Install flush mounting box without damaging vapor barriers, wall insulation or reducing its effectiveness.
- W. Use gang box with plaster ring for single device outlets.
- X. Support outlets flush with suspended ceilings to the building structure.

3.2 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.
- C. Box extenders or plaster rings shall not be used to increase the Code mandated cable capacity of a box.

3.3 FLOOR BOX INSTALLATION

- A. Position floor boxes and conduit runs prior to concrete pour per dimensioned drawings from Architect/Engineer.
- B. After concrete pour, pull wires and install devices according to manufacturer's recommendations.
- C. Activate in accordance with the National Electrical Code.
- D. Coordinate with floor covering contractor to complete installation.

END OF SECTION

SECTION 26 26 00

ELECTRICAL GEAR

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Panelboards and enclosures, including cabinet, as shown, scheduled, indicated, and specified. Safety and disconnect switch work where required, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

- A. UL Standards: All electrical gear shall confirm to all applicable UL standards and shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. General Electric Co.
- B. Square D
- C. Siemens
- D. Eaton

2.2 PANELBOARDS

- A. General: Panelboards shall be dead-front type equipped with fusible switches or circuit breakers as shown and scheduled.
- B. Busing Assembly: Panelboard phase, neutral and equipment ground busing shall be copper. Bus structure and mains shall have ratings as shown and scheduled. Ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or busbar not to exceed 65°C rise above 40°C ambient. Heat rise test shall be conducted in accordance with UL 67. The use of conductor dimensions is not accepted in lieu of actual heat tests. Furnish a bare uninsulated ground bus inside each panelboard enclosure. Two section panelboards shall be connected with copper cable, with an ampacity conforming to the upstream overcurrent device. Panelboards serving non-linear loads and fed with neutrals greater than 100% shall have 200% neutral busing.
- C. Circuit Breakers: Circuit breakers shall be molded case, thermal magnetic type equipped with individually insulated, braced, and protected connectors. The front faces of circuit breakers shall be flush with each other. Tripped indication shall be shown by the breaker handle taking a position between ON and OFF. Make prepared space provisions for additional breakers so that no additional connectors will be required to add breakers. Circuit breakers in panelboards 600 Amps and below shall have bolt-in breakers. Two and three pole breakers shall have internal common trips. External handle ties will not be accepted for line to line connected loads. External handle ties are acceptable only for designated shared neutral loads. Circuit breakers for panelboards rated 601 amps and above shall have plug-on circuit breakers.
 - 1. Provide panelboard branch circuit breakers with interrupting capacity as shown, but in no case less than the following symmetrical amperes RMS:

Voltage (volts)	Interrupting Capacity
120/208/240	10,000 AIC

- 2. Circuit breakers for lighting circuits shall be UL listed switch duty (SWD).

3. Ground fault interrupter (GFI) circuit breakers, where shown, shall be 5 mA ground fault trip and shall include a TEST button.
4. Arc fault circuit breakers shall comply with UL 1699.
5. Circuit breakers with frame size 600A and higher shall have magnetic trip adjustment of 3X to 10X.
6. Provide distribution panel circuit breakers with high interrupting capacity, or integral current limiters as shown. Circuit breakers shall have interrupting capacity not less than the following symmetrical amperes RMS:

CONVENTIONAL FRAME SIZE/ VOLTAGE	INTEGRAL INTERRUPTING CAPACITY
100A/240V	10,000 AIC
225A/240V	25,000 AIC
400A/240V	65,000 AIC
600A/240V	65,000 AIC
800A/240V	65,000 AIC

- D. Fusible Switches: Fusible switches shall be quick-make, quick-break type. Each switch shall be enclosed in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses. Interlock cover with the operating handle to prevent opening the cover when the switch is in the ON position. This interlock shall be constructed so that it can be overridden for testing fuses without interrupting service. The switches shall have padlocking provisions in the OFF position. Switches shall include positive pressure rejection type fuse clips for use with UL Class R or Class J fuses and be UL labeled for 200,000 AIC.
- E. Spaces: Where space for future breakers or switches is shown, panelboard enclosure shall include removable blank panels or knockouts to allow installation of future breakers or switches, prepared spaces, and panelboard busing shall be complete, including required connectors.
- F. Integrated Equipment Rating: Each panelboard, as a complete unit, shall have a short-circuit rating equal or greater than the available short circuit current. Rating shall have been established by tests on similar panelboards with the circuit breakers or fusible switches installed. Series rated panelboards and their protective upstream devices shall be labeled as required by the NEC.
- G. Panelboard Enclosures:
 1. Provide sheet steel enclosures. Provide all NEMA 1 panelboard fronts with spring-loaded door pulls, and flush lock and key.
 2. All NEMA 1 enclosure panelboards shall be hinged "door-in-door" type with interior hinged door with hand operated latch or latches, as required providing access only to circuit breaker or fusible switch operating handles, not to exposed energized parts. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips, or other fasteners, requiring a tool for entry. Hand operated latches are not acceptable. Push inner and outer doors shall open left to right.
 3. Equip with interior circuit directory frame, card, and clear plastic covering for panelboards.
 4. Provide gray powder coat finish over a rust inhibitor.
 5. Enclosures at exterior locations shall be NEMA 3R.
 6. Enclosure shall be for recessed or surface mounting as shown.
 7. Enclosures shall be fabricated by the same manufacturer as panelboards to be enclosed. Multi-section panelboards shall have same physical dimensions.

2.3 ENCLOSED SWITCHES

- A. General: Provide commercial duty type, dead-front, sheet steel enclosed, surface-mounted safety switches of the type and size indicated. Safety switches shall be rated for the voltage of the circuit where they are installed. Safety switches used as motor disconnects shall be

horsepower rated for the motor served.

- B. Switch Mechanism:
 - 1. Safety switches shall be quick-make, quick-break type with permanently attached arc suppressor. Constructed so that switch blades are visible in the OFF position with the door open. The operating handle shall be an integral part of the box, not the cover. Switch shall have provision to padlock in the OFF position. Safety switches shall have a cover interlock to prevent unauthorized opening of the switch door when the switch mechanism is in the ON position, or closing of the switch mechanism when the switch door is open.
 - 2. Cover interlock shall have an override mechanism to permit switch inspection by authorized personnel. Current-carrying parts shall be constructed of high conductivity copper with silver-plated switch contacts. Lugs shall be suitable for copper conductors and front removable.
- C. Fusing: Provide fusible safety switches where required or indicated. Fuse clips shall be positive pressure rejection type fuse clips suitable for use with UL Class R or Class J fuses.
- D. Neutral: Provide safety switches with number of switched poles indicated. Where a neutral is present in the circuit, provide a solid neutral with the safety switch. Where a ground conductor is present in the circuit, provide a separate solid ground with the safety switch.
- E. Enclosures in indoor locations shall be NEMA 1 heavy duty enclosures unless shown otherwise. Enclosures in exterior locations shall be NEMA 3R, heavy duty

2.4 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 250A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
 - a. Instantaneous trip
 - b. Long-and short-time pickup levels.
 - c. Long-and Short-time time adjustments.
 - d. Ground-fault pickup level, time delay and I^2t response
- 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.
- C. Enclosures in indoor locations shall be NEMA 1 heavy duty enclosures unless shown otherwise. Enclosures in exterior locations shall be heavy duty NEMA 3R.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELBOARDS AND ENCLOSURES

- A. General: Install panelboards and enclosures, as shown, including electrical connections, in accordance with the manufacturer's written instructions, the requirements of NEC, NECA Standard of Installation, and industry practices. Circuit breakers shall be factory installed except for required field modifications due to actual site conditions.

- B. Coordination: Coordinate installation of panelboards and enclosures with conductor and raceways installation work.
- C. Anchoring: Anchor enclosures to walls and structural surfaces ensuring that they are permanently and mechanically secured.
- D. Directory Card: Provide a typed circuit directory card(s) upon completion of work. Directory card shall be of super heavy-weight index card stock, 110 lb., white. Directory shall include type of load (i.e.: receptacles, lighting, exhaust fan, etc.) and location (i.e.: Room 102, Office in Room 102, Storage Room north of Room 102, etc.). Room number shall be identified as the actual graphics room number assigned to the space and not the room number identified on the Plans. If no school room number is assigned, list school name for room. List corridors as "corridor". If unsure how to list rooms that may not have a number or name contact maintenance electrical supervisor or his designee. Circuits with shunt trip shall be identified with the control circuit operating the shunt trip (i.e.: Kitchen Hood No. 2). Shunt trip breakers with common trip circuit shall be grouped in the panelboard (i.e.: circuits 1, 3, 5 and 7). All breakers controlled via contactors, or that supply control voltage to contactors shall be noted, and provide information at the bottom of directory card to include exact location of contactors, (example – plenum of Room 100) and how controlled (example – via BMCS). If breakers serve more than one contactor, the notations shall be separate for each contactor. Directory cards shall be large enough, including plastic holders, to include all necessary information. Directory cards are not to be folded to fit in holders. All breaker spaces are to be identified including for 2-pole and 3-pole breakers (list load on each space).
- E. Fuses: Install fuses, of the ratings and class shown, in each power distribution and motor control panelboard.
- F. Circuit Arrangement: Arrange branch circuit connections to 3-phase panelboards so that when two or three circuits are run with a common neutral, each circuit is connected to a different phase unless shown otherwise. Branch circuits shall be connected to the circuit breakers in the panelboard to provide the best possible phase balance, unless shown otherwise.
- G. Panelboards not intended to be used as service entrance (SE) rated shall have the factory installed neutral to ground bonding screws and straps removed.
- H. Spare Conduits: Provide (3) 1-inch conduits capped to 6-inches above accessible ceiling space all recessed panelboards.
- I. Conductors shall be bent neatly opposite the fuse or circuit breaker to which they are to be attached. Vertically installed conductors shall be neatly tie-wrapped. Conductors shall be connected in a neat and professional manner. Conductors brought in from the top or bottom of the cabinet shall be bent neatly opposite the fuse or circuit breaker to which they are to be attached. Each conductor shall be run along the full height of the panel and returned to the circuit breaker or fuse location to allow relocation of the conductor to any position along the bus. Neutral and grounding conductors shall be installed similar to the phase conductors. Panelboard shall be cleaned of all construction debris prior to substantial completion review.
- J. Circuit breakers and conductors installed for SPD devices shall be located at the top or bottom of the panelboard in respect to the location of the SPD device. Route all conductors to the SPD device using long sweep bends and the shortest conductor length possible.
- K. Install copper ground bus for copper ground conductors. Ground conductors size #1 and larger are to be landed to can with mechanical lugs and not to ground bus.
- L. Install panels so that breaker number 1 is the top left breaker. Panel interiors shall not be installed where breaker number 1 is the bottom right breaker.
- M. In panels that contain multi-layered neutral bus install neutrals beginning with the back neutral

bus row and work forward. Do not make up neutrals on front neutral bus row unless all other rows are full.

- N. Label breaker mounting space with stick-on number labels.
- O. Mount the fully aligned panelboard such that the maximum height of the top circuit breaker above the finished floor shall not exceed 78 inches. Mount panelboards that are too high such that the bottom of the cabinets will not be less than 6 inches above the finished floor.
- P. Perform the following actions during the installation of panelboards and similar equipment on 4-wire, delta-connected systems where the midpoint of one phase winding is grounded (240V, 3Ø, high-leg delta systems):
 - 1. Identify the high-leg provided by the serving power company. It shall not be assumed that the high-leg is the same as identified on electrical documents until proper voltage testing and power company coordination has been performed.
 - 2. In existing installations, it shall be permitted for the high-leg to be any phase other than "B" phase. New panelboards installed in these systems shall have their high-leg phase matched to existing panelboards and equipment. All new building electrical system installations shall be performed with the high-leg on the "B" phase of each electrical panelboard.
 - 3. Each panelboard which contains a 4-wire, delta-connected system where the midpoint of one phase winding is grounded shall be legibly and permanently field marked with an orange placard with the following: "Caution ____ Phase Has ____ Volts to Ground. There shall be no phase-to-neutral connections made between this Phase ____ and Neutral within this panelboard."
 - 4. Mark the high-leg phase busbar and conductor durably and permanently with an outer finish that is orange in color.

3.2 ENCLOSED SWITCH AND CIRCUIT BREAKER INSTALLATION

- A. General: Install safety and disconnect switches where required or indicated, in accordance with the manufacturer's written instructions, requirements of the NEC, NECA Standard of Installation, and industry practices. Provide fuse identification label when fused switches are required showing type and size inside door of each switch. Include devices in coordination study to indicate overcurrent devices will selectively coordinate.
- B. Location: Provide safety switches within 50' and in sight of motor served. There shall be minimum 3' clearance in front of safety switch and a clear path in which to access wall mounted switches (ie.: not having to walk and/or stand on obstacles such as drain pans on floor to service).
- C. Supports: Provide all safety and disconnect switches with galvanized angle or other supports where mounting on wall or other rigid surface is impractical. Switches shall not be supported by conduit alone. Where safety and disconnect switches are mounted on equipment served, the switch shall not inhibit removal of service panels or interfere with access areas. Provide mounting hardware that will allow removal of safety and disconnect switches. Do not utilize drive pin anchors through enclosure.
- D. Safety and Disconnect Switches: Install disconnect switches used with motor-driven appliances, motors and controllers within sight of the controller position unless indicated otherwise.

3.3 TESTING

- A. Before energizing, energization, check for continuity of circuits and short circuits.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work Included: Switchboard work as shown, scheduled, indicated, required, and specified.

1.2 QUALITY ASSURANCE

- A. UL Labels: Provide switchboards UL labeled for service entrance and meeting requirements of UL 891.
- B. NEMA Compliance: Comply with National Electrical Manufacturers Association (NEMA) Standard PB2, "Dead-Front Distribution Switchboards."

1.3 SUBMITTALS

- A. Indicate:
 - 1. Detailed dimensions for equipment foot print, front and side elevations.
 - 2. Conduit entrance locations and requirements and restrictions.
 - 3. Enclosure material, finish, and NEMA classification type.
 - 4. Nameplate legends.
 - 5. Size and number of bus bars
 - 6. Switchboard instrument details.
 - 7. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, withstand ratings, and time current curves of all overcurrent devices and components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. General Electric Co.
- C. Siemens
- D. Eaton

2.2 MATERIALS AND COMPONENTS

- A. Except as otherwise indicated, provide switchboard manufacturer's materials and components as indicated and as required for a complete installation.

2.3 DEAD-FRONT DISTRIBUTION SWITCHBOARDS

- A. The overcurrent protective device short circuit, coordination and arc flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
- B. Provide a factory-assembled, dead-front construction, metal enclosed, self supporting, switchboard of voltage, phase, ampacity, and short circuit interrupting rating and bracing shown.
 1. Switchboard shall consist of the required number of front and rear aligned vertical sections bolted together to form one metal enclosed rigid switchboard. The switchboard shall be designed as a free-standing with only front access. Rear and/or side access only where indicated to reduce switchboard depth and where NEC required rear access clearance is available.
 2. Switchboard shall include protective devices and equipment shown with interconnections, instrumentation, and control wiring. Small wiring, necessary fuse blocks, and terminal blocks in the switchboard shall be provided. Groups of control wires leaving the switchboard shall be furnished with terminal blocks with numbering strips.
 3. Factory installed permanent lock-off provision for pad-locking in the off position for all protective devices.
- C. Enclosure Construction: The switchboard framework shall be fabricated for floor mounting. The framework shall be formed code gauge steel, welded and bolted together to support cover plates, busing, and component devices.
 1. Each section shall have an open bottom and individually removable top plates for installation and termination of conduit. Top and bottom conduit areas shall be shown and dimensioned on the shop drawings. Front plates used for mounting meters, selector switches, or other front-mounted devices shall be hinged, with wiring installed and laced, and with flexibility at the hinged side. Closure plates shall be screw removable and small enough for easy handling by one technician.
 2. Weatherproof enclosure front door(s) shall be pad-lockable and suitable for the intended environmental conditions. When indicated or specified, rear doors shall also be pad-lockable.
- D. Busing: The switchboard busing shall be copper.
 1. The bus bars shall be braced to comply with the integrated equipment rating of the switchboard. The main horizontal bus bars between sections shall be located on the back of the switchboard to permit maximum available conduit entry area. The horizontal main bus bar supports, connections, and joints shall be bolted or welded, as required, so as not to require periodic maintenance. Bolted joint connections shall have at least two bolts per joint per phase. Half lapped bus joint construction is not acceptable.
 2. Buses shall be arranged A-B-C, left-to-right, top-to-bottom, and front-to-rear throughout. A ground bus shall be secured to each vertical section structure and extend the entire length of the switchboard.
 3. The main horizontal bus and incoming line shall be isolated and insulated from outgoing busing and cable connections.
 4. Each group mounted section shall have maximum full height bus. Where space is indicated, space shall be bused to install future switches or future circuit breakers sized as shown or a 600 Amp frame size circuit breaker or switch, whichever is greater.

5. The main horizontal bus shall be non-tapered, fully rated, extended and drilled for future additions and splice plates.
- E. Integrated Equipment Rating: Each switchboard, as a complete unit, shall be given a single integrated equipment rating by the manufacturer. The integrated equipment short circuit rating shall certify that equipment can withstand the stresses of a fault equal to that shown in RMS symmetrical amperes. Ratings shall have been established by actual tests by the manufacturer on similar equipment construction as the subject switchboard. This test data shall be available and furnished, if requested, with or before the submittal of shop drawings.
- F. Indicating Instruments: Switchboard instrumentation shall be digital display, panel mounted, rated for 120V, 60 hertz. The display unit shall be UL listed in accordance with UL 508. The electronic metering device shall have the following features:
1. Voltmeter, phase to phase and phase to ground or neutral.
 2. Current, per phase RMS and 3 phase coverage.
 3. Demand current per phase.
 4. Power factor per phase and 3 phase average.
 5. Real power, 3 phase total.
 6. Reactive power, 3 phase total.
 7. Apparent power, 3 phase total.
 8. Frequency.
 9. Average demand real power.
 10. Adjustable demand interval (5 to 60 minutes).
 11. Nonvolatile memory.
 12. Password protected set-up and reset.
 13. 3 current transformers with primary to match bus size and 5 ampere secondary with metering class accuracy.
 14. Full scale readouts with the following accuracy:

a. Current and voltage measurement	+/-0.1%
b. Power and energy	+/-0.2%
c. Frequency	+/-0.5%
d. Power Factor	+/-1.0%
e. Data update time	0.5 seconds (4 wire)
 15. Metering Output.
 - a. Pulse output based on kWh, kvarh, or kVAh.
 - b. Analog output 4-20mA based on kWh, kvarh, or kVAh.
 16. Monitoring:
 - a. Harmonic analysis through 63rd with THD and TIF.
 - b. Event recorder.
 - c. Waveform capture.
 - d. Data logger.
 - e. Triggered trace memory.
 17. Communication:
 - a. Front port and dual rear mounted RS485 ports.
 - b. BACnet protocol (coordinate with BMCS contractor).
 - c. Mini RTU: digital 4 in/4 out.
 - d. Analog 1 in/4 out.
 - e. Local/remote display of all values.
 18. Software:
 - a. Windows based software shall be provided to enable setpoint programming.
- G. The Main Protective Device(s) shall be individually mounted molded case circuit breaker(s):
1. Adjustable: current, I²t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state true RMS sensing, without fusible elements, 100-percent continuous current rating.
 2. Main protective devices with frame rated at 1000 Amps or greater shall have integral ground fault interrupter and provided with a portable test set or test switch.
 3. Circuit breakers with 1,200 Amp frame and above shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

4. Provide shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.
- H. Feeder and Branch Protective Devices greater than 1,200 Amps shall be individually mounted:
1. Molded case circuit breakers:
 - a. Adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state trip true RMS sensing, without fusible elements; 100-percent continuous current rating.
 - b. Energy Reducing Maintenance System switch with local status indicator (ERMS).
 - c. Shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.
 2. Fusible switches:
 - a. Each switch shall have an individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
 - b. Fused switches 600 Amps and below, equipped for class J fuses.
 - c. Fused switches 601 Amps and above shall be equipped with Class R or L rejection type fuse holders. Class RK1 or L of ampere rating and type as indicated on the plans suitable for application of the system.
 - d. When required by the latest edition of the NEC or the AHJ, 1,200 Amp switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- I. Feeder and Branch Protective Devices 1,200 Amps and below shall be group mounted:
1. Molded case circuit breakers:
 - a. Greater than 250 Amp: Solid state true RMS sensing with adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
 - b. 250 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
 - c. 1,200 Amp frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
 2. Fusible switches:
 - a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
 - b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
 - c. 600 Amps and below equipped for Class J fuses.
 - d. 601 Amps and above shall be equipped for Class R or L rejection type fuse holders.
 - e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- J. Mimic bus: Indicate busing, connections, and devices in single line form on the front panels of the switchboard using red colored plastic strips, fastened flat against the panel face with screws.

PART 3 - EXECUTION

3.1 INSTALLATION OF SWITCHBOARDS

- A. Install switchboards where shown, in accordance with the manufacturer's written instructions, and industry practices to ensure that the switchboards meet the specifications. Provide weatherproof NEMA 3R enclosure housing outdoors, at wet locations, or where indicated on the drawings. Provide NEMA 3RX enclosure housing at corrosive locations of either aluminum or stainless-steel construction suitable for the intended environment when indicated on the drawings.
- B. Comply with the requirements of NEMA and NEC, and NECA Standard of Installation, for installation of switchboards.
- C. Where switchboard is used or indicated as the utility service building disconnect, provide main bonding jumper and neutral to ground bond connected to the building's grounding system. Do not bond neutral to ground when there is a neutral to ground bond upstream from the same derived neutral system serving the switchboard.
- D. Torque bus connections and tighten mechanical fasteners.
- E. Install fuses, of ratings shown, in each switchboard. Provide spare fuse cabinet with three fuses of each size provided. Locate in central plant as directed by Owner.
- F. Concrete Pads: Install switchboards on a 4" reinforced concrete housekeeping pad. The housekeeping pad shall extend 3" beyond the housing of the switchboard unless shown otherwise. Switchboard shall be bolted to the housekeeping pad using 3/8" minimum galvanized bolts and anchors on 30" maximum centers. Furnish the exact position of any block outs, dimensions, and location of the housekeeping pads to prevent delay of the concrete work.
- G. Adjustment: Adjust operating mechanisms for free mechanical movement. Adjust circuit breaker time characteristic curves as recommended by the Fault Current and Coordination Analysis or as directed by the Engineer.
- H. Indicating Instruments: Provide initial factory start-up and programming with Owner present. Integrate with the Building Management System for monitoring and logging of all system data.

3.2 TESTING

- A. Pre-energization checks: Before energizing, check switchboards for continuous of circuits and for short circuits.
- B. Switchboard insulation resistance test: Each switchboard bus shall be insulation resistance tested after installation is complete except for line and load side connections. Tests shall be made using Biddle Megger or equivalent test instrument at a voltage of not less than 1000 vDC. Resistance shall be measured from phase-to-phase and from phase-to-ground. Minimum acceptable value for insulation resistance is 2 megohms.
- C. Ground Fault Interrupter (GFI) test: After completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50 percent of overcurrent device rating or 1,200 Amperes, whichever is lower.
- D. Provide thermal infrared scan of switchboard under full load as directed and witnessed by Owner. Correct any deficiencies causing abnormal heating and repeat the scan. Provide digital video disc (DVD) documentation with deficiencies corrected for comparison to future test.
- E. Submittals: Furnish instruments and personnel required for tests. Submit 4 copies of certified test results to the Architect for review. Test reports shall include switchboard tested, date and

time of test, relative humidity, temperature, and weather conditions.

3.3 TRAINING

- A. Provide minimum 2 hours of dedicated training provided by a factory authorized representative to Owner's personnel regarding programming, operating, and use of switchboard components including all indicating instruments and safety features.

END OF SECTION

SECTION 26 24 15

LOAD CENTERS FOR DWELLING UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Load centers, including cabinet, as shown, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

- A. UL Standards: Load centers and enclosures shall confirm to all applicable UL standards and shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB-General Electric Co.
- C. Siemens
- D. Eaton

2.2 MATERIALS AND COMPONENTS

- A. General: Panelboards shall be dead-front type equipped with circuit breakers as shown and as required.
- B. The overcurrent protective device short circuit, coordination and arc flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
- C. Busing Assembly: Panelboard phase, neutral, and equipment ground busing shall be aluminum or copper. Bus structure and mains shall have ratings as shown and scheduled. Furnish a bare uninsulated ground bus inside each panelboard enclosure. Neutral bus termination quantity shall match or exceed the maximum number of single pole circuit breakers the load center will accept.
- D. Main circuit breakers and feeder / branch circuit breakers:
 - 1. Thermal magnetic with factory fixed trip.
 - 2. 125-600 Amps: Thermal magnetic with adjustable instantaneous trip of 5X – 10X with short time tracking.
 - 3. General requirements:
 - a. Two pole breakers shall have internal common trips.
 - b. All circuit breakers used as the main or branch mounted back-fed main shall be bolt-on.
 - c. Load centers shall have interrupting capacity as shown or as required, but in no case less 10k AIC for 120/208/240-Volt systems.

- d. Personnel ground fault interrupter (GFI) circuit breakers, where shown, shall be maximum 5 mA ground fault trip and shall include a TEST button.
- E. Spaces: Where space for future breakers or switches is shown, panelboard enclosure shall include removable blank panels or knockouts to allow installation of future breakers or switches.
- F. Integrated Equipment Rating: Do not apply series ratings. Each load center, as a complete unit, shall have a short-circuit rating equal or greater than the available short circuit current. Rating shall have been established by tests on similar panelboards with the circuit breakers or fusible switches installed.
- G. Load center enclosures:
 - 1. Provide sheet steel enclosures, minimum 16-gauge nominal thickness, with multiple knockouts, unless shown otherwise.
 - 2. Equip with interior circuit directory frame, card, and clear plastic covering for panelboards.
 - 3. Enclosure shall be for recessed or surface mounting as shown or as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELBOARDS AND ENCLOSURES

- A. General: Install load centers only within the confines of the residential dwelling unit it serves, as shown, including electrical connections, in accordance with the manufacturer's written instructions, the requirements of NEC, NECA Standard of Installation, and industry practices.
- B. Coordination: Coordinate installation of panelboards and enclosures with conductor and raceways installation work.
- C. Anchoring: Anchor enclosures to walls and structural surfaces ensuring that they are permanently and mechanically secured.
- D. Directory Card: Provide a typed circuit directory card(s) upon completion of work. Directory card shall be of super heavy-weight index card stock, 110 lb, white. Directory shall include type of load (i.e.: receptacles, lighting, exhaust fan, etc.) and location (i.e.: Dining Room, Bath Room, etc.).
- E. Circuit Arrangement: Branch circuits shall be arranged to provide the best possible phase balance, unless shown otherwise.
- F. Load centers not intended to be used as service entrance (SE) rated or for establishing a separately derived neutral system shall have the factory installed neutral to ground bonding screws and straps removed and disposed of.
- G. Conductors shall be bent neatly opposite circuit breaker to which they are to be attached. Conductors shall be connected in a neat and professional manner. Conductors brought in from the top or bottom of the cabinet shall be bent neatly opposite the circuit breaker to which they are to be attached. Each conductor shall be run along the full height of the panel and returned to the circuit breaker location to allow relocation of the conductor to any position along the bus. Panelboard shall be cleaned of all construction debris prior to substantial completion review. Neutral and grounding conductors shall be installed similar to the phase conductors.
- H. Circuit breakers and conductors installed for SPD devices shall be located at the top or bottom of the load center in respect to the location of the SPD device. Route all conductors to the SPD device with straight as possible run, using longest sweep bends and the shortest conductor length possible. Twist all SPD conductors and secure with tie straps wherever possible.

- I. Install load centers so that breaker number 1 is the top left breaker.
- J. Label breaker mounting space with stick-on number labels.
- K. Mount the fully aligned panelboard such that the maximum height of the top circuit breaker above the finished floor shall not exceed 78-inches. Mount panelboards as high as practical and such that the bottom of the cabinets will not be less than 6 inches above the finished floor.

3.2 TESTING

- A. Before energizing, energization, check for continuity of circuits and short circuits.

END OF SECTION

SECTION 26 27 13

RESIDENTIAL METERING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work Included: Switchboard work as shown, scheduled, indicated, and specified.
- B. Types: Metering Systems required for the project include power distribution metered switchgear.

1.2 QUALITY ASSURANCE

- A. UL Labels: Provide switchboards UL labeled for service entrance and meeting requirements of UL 891.
- B. NEMA Compliance: Comply with National Electrical Manufacturers Association (NEMA) Standard PB2
- C. Comply with all requirements of Entergy

1.3 SUBMITTALS

- A. Indicate detailed dimensions for the front and side views.
- B. Indicate conduit entrance locations and requirements.
- C. Indicate enclosure material finish and NEMA classification type.
- D. Indicate nameplate legends.
- E. Indicate size and number of bus bars and ground; switchboard instrument details.
- F. Include electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time current curves of all equipment and components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. General Electric Co.
- B. Square D
- C. Siemens
- D. Cutler-Hammer.

2.2 MATERIALS AND COMPONENTS

- A. Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended, and as required for a complete installation.

2.3 DEAD-FRONT METERING SYSTEM

- A. Provide a factory-assembled, dead-front, NEMA 1 construction, metal enclosed, self supporting, metering system of voltage, phase, ampacity, and short circuit bracing shown.
 - 1. Metering System shall consist of the required number of front and rear aligned vertical sections bolted together to form one metal enclosed rigid metering system.
- B. Completely assembled and self-contained metering devices shall be in accordance with the plans and descriptions herein, equal to Siemens Unified Uni-Pak metering with branch breakers immediately adjacent to the meter socket, in a separate compartment for positive identification.
- C. Metering devices shall be suitable for use as service entrance equipment. The service entrance compartment shall provide for sealing and shall have lay-in lugs suitable for the service entrance cable.
- D. Main cross-bus shall have a rating equivalent to the service entrance cable.
- E. Vertical bus shall be welded to the main horizontal bus connection straps with bolts accessible through the socket bases. Bus connections shall be provided between socket load jaws and individual branch breakers.
- F. The unmetrated bus in each meter section shall be completely barriered off to prevent unauthorized access to current. Meters sockets shall have individual covers of ring or ringless style design. A separate compartment under a separate cover shall be supplied for branch circuit breakers. Covers over tenant section wireways shall be removable with the watt-hour meters sealed in place.
- G. All current carrying parts shall be tin-plated to resist corrosion. Branch breakers shall be quick-break and trip indicating. All lugs shall be suitable for use with 60 / 75 degree C copper or aluminum wire.
- H. Metering system metering shall have meter sockets listed by Underwriters Laboratories, Inc. and shall be continuous duty rated. They shall be rated for 125 or 200 amperes and shall have provisions for 15-125 or 15-200 ampere, 2-pole branch breakers. Line side meter jaws shall have meter guides. All meter jaws shall be spring reinforced.
- I. Integrated Equipment Rating: Each switchboard, as a complete unit, shall be given a single integrated equipment rating by the manufacturer. The integrated equipment short circuit rating shall certify that equipment is capable of withstanding the stresses of a fault equal to that shown in RMS symmetrical amperes. Ratings shall have been established by actual tests by the manufacturer on similar equipment construction as the subject switchboard. This test data shall be available and furnished, if requested, with or before the submittal of shop drawings.

PART 3 - EXECUTION

3.1 INSTALLATION OF METERING SYSTEM

- A. Install metering system where shown, in accordance with the electric utility, manufacturer's written instructions, and industry practices to ensure that the metering systems meet the specifications.
- B. Comply with the requirements of NEMA and NEC, and NECA Standard of Installation, for installation of switchboards.
- C. Torque bus connections and tighten mechanical fasteners.
- D. Adjustment: Adjust operating mechanisms for free mechanical movement. Adjust main circuit breaker time characteristic curves as directed by the Engineer.

3.2 TESTING

- A. Pre-Energization Checks: Before energizing, check metering system for continuous of circuits and for short circuits.
- B. Switchboard Insulation Resistance Test: Each metering system bus shall be insulation resistance tested after installation is complete except for line and load side connections. Tests shall be made using Biddle Megger or equivalent test instrument at a voltage of not less than 1000 VDC. Resistance shall be measured from phase-to-phase and from phase-to-ground. Minimum acceptable value for insulation resistance is 2 megohms.

END OF SECTION

SECTION 27 26 73

WIRING DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide wiring device work as shown, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

- A. UL Label: Wiring devices shall be UL labeled.
- B. NEMA Standard WD1 and WD6
- C. Fed. Spec. WC596, W-S-896

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Leviton, Mfg. Co., Inc.
- B. Pass and Seymour, Inc.
- C. Hubbell, Inc.
- D. Cooper – Arrow Hart
- E. Lutron, Inc. (Dimming)

2.2 WIRING DEVICE COLOR

- A. Device color shall be white except 20A, 125V receptacles and toggle wall switches which are directly supplied from an emergency source shall be red. Verify with Architect prior to submitting for approval.

2.3 RECEPTACLES

- A. Commercial grade receptacles, NEMA configuration indicated.
 - 1. 20A, 125V grounded duplex NEMA #5-20R: Leviton #16352 or equal
 - 2. 20A, 125V ground fault circuit interruption (GFCI) NEMA #5-20R: Leviton #7898 or equal
 - 3. Provide weather resistant (WR) receptacles at all exterior locations

2.4 WALL SWITCHES

- A. Toggle: Commercial grade flush toggle switches, with mounting yoke insulated from mechanism, equipped with plaster ears, switch handle, back and side-wired screw terminals.
 - 1. Single-pole, 120/277V, 20A switch: Leviton #54521 or equal
 - 2. Double Pole 120/277V, 20A switch: Leviton #54522 or equal

2.5 INTERIOR WALL COVER PLATES

- A. Smooth finish, molded of high impact nylon.
 - 1. Plate color shall match device and/or toggle color.
 - 2. Fastening screws shall match plate color.

2.6 EXTERIOR RECEPTACLE COVER PLATES

- A. Thomas & Betts CKSUV, cast aluminum standard depth, locking mount, while-in-use, wet location, universal configuration.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All wiring devices for receptacles and wall switches shall be of the same manufacturer throughout unless otherwise noted.
- B. Install wiring devices where shown, in accordance with manufacturer's written instructions, requirements of NEC, and in accordance with industry practices. Do not install devices until wall construction and wiring is completed.
- C. Install receptacles and switches only in electrical boxes that are clean, free from excess building materials, debris, and similar matter.
- D. Install wiring devices plumb and aligned in the plane of the wall, floor, or ceiling in where they are installed.
- E. Install switches in boxes on the strike side of doors as hung. Verify door swing ogf all doors prior to rough-in. Install a uniform position so the same direction will open and close the circuit throughout the project. Where more than one switch is in the same location, install switches in a multi-gang box with a single cover plate.
- F. Provide a plate for every receptacle, switch, telephone outlet and other wiring devices
- G. Mounting heights of all wiring devices shall comply with current Accessibility Standards and local codes, except where wiring devices are indicated for special purpose and access is only required by maintenance or service personnel.
- H. Refer to Architectural drawing, elevations, etc. for exact location of wiring devices where indicated on the Architectural plans. Coordinate location of all wiring devices with other specialty items and millwork and avoid conflicts. Coordinate with all trades to avoid conflicts during construction.
- I. Locate receptacles for electric drinking fountains so that the receptacle is accessible and concealed as much as practical from public view.
- J. Provide weatherproof and weather resistant (WR) GFCI, 20A, 125V duplex receptacles outdoors where indicated and within 25' of all new electrically operated equipment mounted outdoors and on roofs.
- K. Provide GFCI, 20A, 125V duplex receptacles at all receptacle locations in custodial rooms, electric drinking fountains, vending machines, kitchen and food preparation areas, and all locations where receptacles indicated are within six feet of water sources, sinks, lavatories, faucets, and mop sinks. Where outlet is indicated behind vending machines or drinking fountain cowlings, or other equipment, provide remote GFCI blank face in readily accessible location with standard receptacle outlet behind equipment.
- L. Install wall box dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.
- M. Do not share neutral conductor on dimming circuits.
- N. Install receptacles with grounding pole down, or as directed by Owner. If installed horizontally, install with neutral on top.
- O. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

- P. Connect wiring devices by wrapping ground conductor around screw terminal or inserting into mechanical lug. Provide pigtail to each receptacle and each switch. Neutral and phase conductors shall be installed using side or rear entry lugs only. Do not wrap neutral and phase conductors around screw terminals. Tighten all screws and lugs as recommended by manufacturer.
- Q. Provide nameplate engraving for emergency outlets at locations indicating panelboard and circuit number.

3.2 TESTING

- A. Before energizing, check for continuity of circuits, short circuits, and grounding connections. After energizing, check wiring devices to demonstrate proper operation and receptacles for correct polarization. Test GFCI receptacle operation with simulated ground fault tester.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

END OF SECTION

SECTION 26 32 13

NATURAL GAS STANDBY GENERATOR SETS AND TRANSFER SWITCH

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Conditions of the Contract and applicable requirements of Division 1 and Section 26 05 00 govern this Section.

1.2 WORK INCLUDED

- A. Furnish and install standby engine-driven generator system, complete with wiring and controls as shown on the drawings and as specified herein.
- B. The standby emergency system shall consist of an engine-driven generator set designed and sized for specified ambient conditions and project site altitude, complete for outdoor installation where specified or required outdoors, automatic transfer switches and associated fuel system.

1.3 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
 - 1. Engine-Driven Generator Sets:
 - a. Onan/Cummins/Southern Plains Power
 - b. Taylor Power
 - c. Generac Industrial
 - d. Caterpillar
 - e. Rehlko/Kohler
 - B. Automatic Transfer Switch.
 - a. Onan
 - b. Russelectric
 - c. ASCO
 - d. Zenith
 - e. Eaton
 - f. Standby electric generating system manufacturer (as an integral part of a complete system).
- C. NEC and NFPA Compliance: Comply with applicable portions of the NEC (NFPA 70) including, but not limited to, emergency and standby power generation systems (NFPA 99 & 110), and with NFPA 37 Installation and Use of Stationary Combustion Engines and Gas Turbines.
- D. IEEE Compliance: Comply with applicable Institute of Electrical and Electronics Engineers, Inc. (IEEE) standards pertaining to generator construction.
- E. EPA Compliance: Comply with all EPA Standards for permanently installed natural gas emergency generators.
- F. Testing: The generator set shall receive the manufacturer's standard factory load testing.
- G. Supplier: All equipment provided shall be supplied by an authorized distributor of the manufacturer who has been continuously engaged in the distribution of industrial grade Power System products for a minimum of 15 years. The supplier shall provide initial start-up services, conduct field acceptance testing, and warranty service. The supplier is to be authorized to perform warranty service on all products provided. Within 50 miles of the job site, the supplier shall maintain; a minimum of 6 factory-trained and qualified field technicians; a proper supply

of spare parts for the supplied equipment; a shop with overhaul capabilities; and be able to provide 24 hour, 7 day per week, 365 day per year field service capability.

1.4 SUBMITTALS

- A. Submit manufacturer's certified computer generated performance and capacity data in accordance with specification requirements. Indicate and include all ambient and altitude deratings and calculations.
- B. Submit manufacturers' "Installation, Start-Up and Service" instructions:
 - 1. Recommended conductors, overcurrent protection and disconnect size
 - 2. Electrical interlocks
- C. Submit recommended clearance dimensions.
- D. Submit internal wiring diagram of Control Center.
- E. Submit sequence of operation in narrative form.

1.5 WARRANTY

- A. Provide five-year parts and labor warranty from date of substantial completion for generator set(s) and transfer switch(es).

PART 2 - PRODUCTS

2.1 ENGINE-GENERATOR SETS

- A. The engine-generator set shall be furnished as a complete working system. The model provided shall be a standard model that is quality assurance tested and prototype tested, not one of a kind without supporting literature.
- B. Engine shall be liquid cooled, reciprocating engine, 12V DC electric start, natural gas fueled, electronic isochronous governed with manual speed adjustment plus/minus 5%, with belt-driven battery charging alternator.
- C. The set shall provide the following performance:
 - 1. Rated power for the duration of any utility power outage, in ambient conditions to 500-foot altitude and an outside air ambient temperature of 10 degrees F to 110 degrees F. Liquid coolant system ratings for natural gas sets through 140KW shall be rated at 122 degrees F ambient.
 - 2. Start and accept rated load within 10 seconds of utility power outage.
 - 3. Voltage regulation of plus/minus 2% no load to full load with random voltage variation, at any constant load, less than plus/minus 1%.
 - 4. Isochronous frequency regulation, less than plus/minus 0.5% at any steady state load from no load to full load.
- D. Engine Coupling: Engine shall be directly connected to the generator through a suitable flexible coupling.
- E. Generator:
 - 1. The generator shall be a standard make, 4-pole, revolving field, single bearing, synchronous, brushless type with the following characteristics:
 - a. Capacity as shown on the drawings and shall operate at 1800 rpm.
 - b. Dripproof, self-ventilating, permanently aligned and complete with rotating brushless exciter and shall be of ball bearing construction and connected to the engine with flexible disc coupling.
 - c. Conform to the latest applicable IEEE and NEMA standards.
 - d. Provided with generator overload protection or generator manufacturer's

- overload protective circuitry.
 - e. Output main circuit breaker(s) with adjustable LIS trip for cable protection shall be provided when shown on drawings. Circuit breaker manufacturer shall be the same as switchgear manufacturers specified and submitted to be used on this project.
 - f. Voltage Regulator: Include a full wave rectified automatic digital voltage regulation system matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from mis-operation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field.
 - g. Alternator: The generator shall be capable of withstanding a three phase load of 300% rated current for 10 seconds, and sustaining 150% of continuous load current for 2 minutes with field set for normal rated load excitation.
- 2. Provide the generator with the following:
 - a. Minimum 130°C rise stand-by rating
 - b. NEMA Class F or H insulation as defined by NEMA MG1.65
 - c. Temperature rise by resistance and embedded detector measurements at rated load within NEMA MG1-22.40 definition.
 - d. Pre-lubricated, maintenance free ball bearing, lubricated for life.
 - e. Direct drive centrifugal blower cooling.
 - f. RFI filters on the exciter to eliminate radio frequency interference on electronic equipment.
 - g. Thermostatically controlled block strip heater mounted for condensation control.
- F. Sub-Base: The engine power plant shall be mounted on an I beam, box type sub-base of fabricated steel construction. The assembly shall be installed on a vibration-absorbing base on a concrete pad as shown on the drawings.
- G. Automatic Starting Sequence of Events:
 - 1. Upon drop in normal source voltage to 65 to 70% of rated voltage, or upon failure of the normal source of electrical supply, the engine shall be automatically cranked and brought up to the full operating speed.
 - 2. The cranking motor circuit shall be instantly broken when the engine starts.
 - 3. Within 10 seconds the generator shall be brought up to operating speed; the generator voltage shall operate the automatic transfer switch, disconnecting the load from the normal source of supply and connecting the emergency power to the load.
 - 4. Upon restoration of the normal source voltage to 92 to 95% of rated voltage or restoration of normal source of supply, the sequence shall be reversed, restoring the transfer switch to the automatic normal operating position, disconnecting the load from the emergency generator and reconnecting the load to the normal source of supply. The emergency generator set will continue to operate for a period of from 1 to 5 minutes after the restoration of the normal source of supply. Should the engine fail to start upon the first crank, there shall be two additional cranking attempts made with a 15 second rest between cranks, after which the cranking cycle shall cease and an alarm shall sound to indicate malfunctioning of the system.
 - 5. The controls shall automatically stop the engine in the event the cooling water temperature becomes too high, if the coolant level becomes too low, if the oil pressure drops below a pre-determined pressure, or if the engine overspeeds. Upon the failure of the engine for any of the above reasons, an indicating lamp will operate indicating the condition under which the engine was shut down. Also, the alarm signal

shall be energized.

- H. Engine Control Panel & Accessories:
1. Provide a comprehensive monitoring and control system integral to the Generator Set control to guard the electrical integrity of the alternator and power system. Provide single and 3-phase fault current regulation, so that downstream protective devices have the maximum current available to quickly clear fault conditions, without subjecting the alternator to potentially catastrophic failure conditions. Include provisions to either prevent over voltage due to single phase faults, or to shut down the generator set if line to neutral voltage on any phase exceeds 115% for more than 0.5 seconds. Acceptable methods are a fully rated (100%) 600 volt Circuit Breaker, mounted in the generator enclosure, Schneider Electric - Square D Programmable Micrologic of size as indicated on drawings with handheld programmer or inherent protection provided by microprocessor-based GenSet AmpSentry protection. Submittals shall demonstrate that the protective device provides proper protection for the alternator by a comparison of the trip characteristic of the breaker with the thermal damage characteristic of the alternator. Field circuit breakers shall not be acceptable for generator overcurrent protection. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed. The governing system shall include a programmable warm up at idle and cool-down at idle function. While operating in idle state, the control system shall disable the alternator excitation system. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The Control Panel shall include, but is not be limited to, the following instruments and protective devices:
 - a. AC Ammeter.
 - b. Phase Selector Switch.
 - c. Current Transformers.
 - d. AC Voltmeter.
 - e. Automatic Solid State Voltage Regulator with immunity to severe induced waveshape distortion from nonlinear loads.
 - f. Rheostat for Adjusting voltage $\pm 5\%$ of Rated Voltage.
 - g. Engine Malfunction Warning Lights/Audible Alarm:
 - 1) Anticipating High Engine Temperature.
 - 2) Anticipatory Low Oil Pressure.
 - 3) Low Fuel.
 - 4) Control Switch not in Automatic Position.
 - 5) Low Water Temperature.
 - 6) Low Oil Pressure.
 - 7) High Water Temperature.
 - 8) Engine Overcrank.
 - 9) Engine Overspeed.
 - h. Frequency Meter.
 - i. Non-resettable Elapsed Time Meter with a 9,999.9 Hour Maximum Indication.
 - j. Coolant Temperature Gauge.
 - k. Oil Pressure Gauge.
 - l. Provisions for Remote Emergency Shutdown.
 - m. Combination alarm shutdown system with manual reset and indicating lights for high engine temperature, low oil pressure, engine overspeed, and engine failed to start. Include an additional set of contacts for remote alarms.
 - n. Manual run/off/automatic selector switch for control of engine with flashing red light, and shall allow manual starting of plant without assuming load.
 2. Provide low coolant level shutdown, which shall activate high engine temperature lamp and shutdown.
 3. Solid-state cranking cycle device preset at 15 second cranking cycle and 15 second

- rest cycle followed by a 15 second cranking cycle. If engine fails to start after 3 crank cycles and 2 rest cycles, an overcranking alarm shall sound and cranking cycle shall stop. Provide adjustments in accordance with manufacturers recommendations, but cumulative crank-rest timing shall not be less than 75 seconds.
4. In the event of engine failure, the panel shall close alarm circuit, indicate the fault on the appropriate lamp and shut down the engine. The panel shall include a manual reset switch so that the panel can be reset immediately after a fault condition. Reset devices that require a waiting period are not acceptable.
- I. Options and accessories shall include the following:
1. Housing: The complete engine generator set shall be enclosed in a free-standing weather protective, aluminum (0.063-inch) panel construction housing with lockable, removable hinged door panels, hinged instrument panel door and panel light. Housing shall be wind rated to 150 mph.
 - a. All parts shall be adequately protected against oxidation and corrosion and finish painted with durable machinery enamel, minimum of 3 mils applied in a maximum of 1-1/2 mils per application.
 - b. Include within the enclosure a switched LED vapor-tight luminaire on each side of the engine and a GFCI receptacle.
 - c. The enclosure must maintain the engine and generator at 32°F or be equipped with space heaters to maintain starting batteries between 50°F and 90°F.
 2. 12V battery starting with maintenance free lead acid batteries with dual rate solid state automatic battery charger, with equalize timer, low and high battery voltage indicators and alarm terminals, charger malfunction indicator and alarm. Batteries shall be capable of providing two 45 second continuous cranking cycles. Provide battery racks, and charger shall be protected from any other charging source.
 3. Muffler, critical silencing, with condensation drain; stainless steel flexible exhaust connector. Silencer shall mount horizontally on structural support (of housing) with 90° elbow termination with rain cap.
 4. Premium exhaust rain cap, cast aluminum, stainless steel hardware, brass bushing hinge.
 5. Gas line accessories as required for the set to include but not limited to gas line strainer, 12" braided metallic flexible fuel line, battery power operated gas line shut-off solenoid valve, pressure reducing regulator fuel pressure gauge.
 - a. Contractor shall provide natural gas fuel piping for the emergency generator set. Contractor shall install natural gas line fittings obtained from electrical contractor (as supplied with the engine generator). Plumbing line work for natural gas for the engine generator shall be with as few elbows and bends as possible (as near a straight line run from the gas supply tee-off as possible).
 6. Water jacket heater, 120 VAC, 1 phase, 1500 watts minimum.
 7. Unit mounted emergency shut-off mushroom type pushbutton switch.
- J. Testing: The unit shall be given a complete shop test before shipment. It shall be installed on the job under supervision of the manufacturer's representative, and shall receive start-up/commissioning service from that representative.
1. The unit shall be started cold and run for a one-hour test with building load connected. Provide additional load bank as required to achieve 100 percent loading.
 2. Retransfer the load after test.
 3. After this test, the set shall cool for five minutes, then must start and carry full building load for four hours.
 4. Demonstrate the cranking cycle and all engine safety devices. The Owner's authorized representative shall be instructed in the operation and maintenance of the unit.
- K. Instruction Data and Drawings: Commercial type operating instructions shall be provided consisting of operating and maintenance manuals, parts books, dimensional drawings and wiring diagrams. Three copies of dimensional drawings and wiring diagrams shall be provided

as specified.

1. Operating Instructions: Provide and install in a suitable enclosure operating instructions for the engine generator set.
2. Contractor shall fill the radiator with a combination of water and ethylene-glycol to protect the radiator to -20°F after completion of the test.

2.2 AUTOMATIC TRANSFER SWITCHES

A. Rating and Construction:

1. Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, voltage and ampere ratings, enclosures and accessories. All transfer switches shall have switched neutrals and shall be electrically operated and mechanically held.
3. All transfer switches and accessories shall be UL listed and labeled, tested per UL Standard 1008, and CSA Approved, and comply with NEMA ICS 2-447. When protected by molded case breaker withstand and closing ratings shall not be less than the following RMS symmetrical amps at 600 VAC:

Switch Size in Amps	WCR @ 480 Volts
Up to 260	30,000
300 to 1000	65,000
1200	85,000
1600 and larger	100,000

4. Provide one of the following standard products:
 - a. Onan OTEC or OTPC Series as required
 - b. Standby Generator System Manufacturer, provided as a complete system
 - c. ASCO 940 Series
 - d. Russelectric RMT/RMTD Series
 - e. Zenith ZTSD Series
5. Electrical operation shall be accomplished by a momentarily energized single solenoid operating mechanism which receives power from the source to which the load is being transferred. Fuse or thermal protection of the main operator is prohibited. The operating transfer time shall be 1/6 of a second or less. Mechanical locking in each position shall be accomplished without the aid of permanent magnets, latching solenoid, or motor operators.
6. Operation shall be inherently double-throw whereby all contacts move simultaneously and with no programmed delay in a neutral position. Electrical spacing shall be equal to or exceed those listed in table 15.1 of UL 1008. Only those main contact structures specifically manufactured for transfer switch service shall be acceptable. An overload or short circuit shall not cause the switch to go to a neutral position.
7. Inspection of all contacts (movable and stationary) shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The maintenance handle shall permit the operator to stop the contacts at any point throughout the entire travel to properly inspect and service the contacts when required.
8. All switches for systems with switched neutrals shall have fully rated neutral transfer contacts that momentarily interconnect the neutrals of the sources and load for 100 milliseconds maximum, during the transfer/retransfer operation. The neutrals shall remain so interconnected until the line contacts close on the alternate source. Line and neutral contacts shall be driven by a single main operator.

B. Controls and Accessories:

1. Controls shall provide for the automatic starting sequence of the generator set.
2. Automatic controls shall signal the engine-generator set to start upon signal from normal source sensors. Solid state time delay start, adjustable from 0 to 5 seconds (factory set at 2 seconds) shall avoid nuisance start-ups. Battery voltage starting contacts shall be gold, dry type contacts factory wired to a field wiring terminal block.
3. The switch shall transfer when the emergency source reaches the set point voltage

- and frequency. Provide a solid state time delay on transfer, adjustable from 0 to 120 seconds.
4. The switch shall retransfer the load to the normal source after a time delay retransfer, adjustable from 0 to 30 minutes. Retransfer time delay shall be immediately bypassed if the emergency power source fails.
5. Control shall be solid state and designed for a high level of immunity to power line surges and transients, demonstrated by test to IEEE Standard 587-1980. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs. Control shall be quick disconnect for ease of service.
6. Solid state undervoltage sensors shall simultaneously monitor all phases of both sources. Pick-up and dropout settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage.
7. For transfer switches serving non-disconnected motor loads, equip with a field adjustable time delay during switching in both directions, during which time the load is isolated from both power sources, to allow load residual voltage to decay before closure to the opposite source. The delay feature shall have an adjustable range covering 0 to 7.5 seconds. Transfer switches serving life safety equipment shall have this time delay set at 0 at startup/commissioning.
8. Controls shall signal the engine-generator set to stop after a time delay, adjustable from 0 to 10 minutes, beginning on return to the normal source.
9. Power for transfer operation shall be from the source to which the load is being transferred.
10. The control shall include latching diagnostic indicators to pinpoint the last successful step in the sequence of control functions, and to indicate the present status of the control functions in real time.
11. The control shall include provisions for remote transfer inhibit and area protection.
12. Provide front panel devices mounted on cabinet front consisting of:
 - a. A key operated selector switch to provide the following positions and functions:
 - 1) Test - Simulates normal power loss to control for testing of generator set. Controls shall provide for a test with or without load transfer. Program for load transfer.
 - 2) Normal - Normal operating position.
 - 3) Retransfer - Momentary position to override retransfer time delay and cause immediate return to normal source, if available.
13. Exerciser Clock: Provide solid state exerciser clock to set the day, time, and duration of generator set exercise/test period. Provide a with/without load selector switch for the exercise period. Program for a time and day as determined by the owner.
14. Provide Phase Sequence Monitor/Balance Module to protect against inadvertent phase rotation hookup and monitor for voltage phase imbalance between phases.
15. Where elevator loads or load disconnect of motor controls are shown on the plans, provide in switches serving elevators or motors the following:
 - a. Signal module to delay the transfer and retransfer of the switch for up to 50 seconds to provide a pre-transfer warning or load disconnect signal contact. Provide signals for the following conditions:
 - source 1 available
 - source 2 available
 - test/exercise
 - backup source availableContacts for these functions are to be Form C type, rated for 120 VAC or 30 VDC at 4 amps.
16. When shown on the plans, provide a load shed relay, to move the transfer switch from the emergency position to a neutral position, on receipt of a signal from a remote device.
17. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The control panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The control panel

shall communicate with the engine generator, including display of all engine and alternator data, and other transfer switch data in the power system. The control panel shall allow starting and stopping of the generator set via the transfer switch control panel in both test and emergency modes.

18. Submittals:
 - a. Submittal drawings and information on the transfer switches including installation drawings, wiring diagrams, dimensions, weights, etc. shall be provided. Full descriptive information on accessory items shall be furnished. All submittals shall be reviewed by the Engineer and approved prior to fabrication.
19. Instruction Data and Drawings:
 - a. Commercial type operating instructions shall be provided consisting of operating and maintenance manuals, parts books, dimensional drawings and wiring diagrams.
 - b. Operating Instructions: Provide and install in a Plexiglas enclosure complete operating instructions for each type of transfer switch.

2.3 REMOTE ANNUNCIATION PANEL

- A. Locate next to ATS. Provide flush mounted with stainless steel plate containing the following:
 1. Trouble sonnet horn with silence switch.
 2. Illuminated annunciators with nameplates in accordance with the following table:

Lamp Legend	Generator Set Condition Indicated	Light	Audible Alarm
High Battery Voltage	Battery charger too high	Red	No
Low Battery Voltage	Battery voltage too low	Red	No
Normal Battery Voltage	Battery voltage ok	Green	No
Generator Running	Generator has output voltage	Green	No
Normal Utility Power	Utility power supplying the load	Green	No
EPS Supplying Load	Genset supplying the load	Green	No
Pre-Low Oil Pressure	Oil pressure approaching low limit	Yellow	Yes
Low Oil Pressure	Engine has shut down due to low oil pressure	Red	Yes
Pre-High Coolant Temp.	Temperature of coolant approaching high limit	Yellow	Yes
High Coolant Temp.	Genset has shut down due to high coolant temp.	Red	Yes
Low Engine Temp.	Engine heater has malfunctioned	Red	Yes
Overspeed	Engine has shut down due to overspeed	Red	Yes
Overcrank	Engine failed to start	Red	Yes
Not In Auto	Engine control switch not in AUTO position	Flashing Red	Yes
Battery Charger Malfunction	Charger is signaling a failure	Red	Yes
Low Fuel	Fuel level below preset minimum	Red	Yes
Fault	Customer preselected condition	Red	Yes

- B. Name plates shall be laminated black with white letters engraved. Letter size shall be a minimum of 3/8" high.
- C. Illuminated annunciators shall be 1 inch minimum.

2.4 ELECTRICAL AND MECHANICAL PERFORMANCE

- A. The switch must comply with UL 1008 and NEMA Standard Publication ICS 2-447. In addition, the switch must meet or exceed the following requirements and if so requested, be verified by certified laboratory test report.

1. Temperature Rise: Measurements shall be made after the overload and the endurance tests.
2. Withstand: UL listed to withstand the magnitude of fault current available at the switch terminals when coordinated with respective protective devices at an X/R ratio of 6.6 or less. The main contacts of the transfer switch shall not trip open or weld when subjected to fault currents.
3. Dielectric: Test, following the withstand current rating test, at 1960 volts AC rms minimum.
4. Transient Withstandability: Control panel voltage surge withstand capability test per IEEE Standard 472-1974 and voltage impulse withstand test per NEMA Standard publication ICS-1-109.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install standby engine driven generator set where shown, in accordance with the equipment manufacturer's written instructions and recognized industry practices, to ensure that the set complies with the specified requirements and serve the intended purposes.
- B. Standard: Comply with NEMA standards, requirements of the NEC, and applicable portions of NECA Standard of Installation pertaining to installation of standby engine-driven generator sets and accessories.
- C. Vibration Isolation:
 1. Outside Mounted: Ribbed Neoprene Vibration Isolation
 2. Roof Mounted: Install units on properly sized spring-type vibration mounts and ribbed Neoprene vibrations isolators.
 3. Generator installed inside building: Install units on properly sized spring-type vibration mounts and ribbed Neoprene vibration isolators.
- D. Concrete Pad: Install generator set on a reinforced concrete pad. The generator pad shall extend 6" beyond the generator set base, unless shown otherwise. Furnish the exact position of any block outs, mounting bolts, and the dimensions and location of the generator pad in a timely manner so as to prevent delay of the concrete work. Refer to Section 26 05 00 for housekeeping pads and Division 3 for Concrete Work.
- E. Options and Accessories: Provide circuits, conductors, and raceways as required for generator options and accessories as specified. Provide separate circuits from the emergency lighting and appliance panel board to the generator, heaters, lighting, battery chargers, etc. as required, for a fully operational system.
- F. Provide remote alarm annunciator. Coordinate final location of remote annunciator with Owner / Architect prior to installation. It may be installed adjacent to fire alarm panel, or within Administration or Custodial areas of the building.
- G. Provide dry contacts and outputs to monitor transfer switch and generator alarm conditions.
- H. Adjust main output circuit breaker(s) adjustable trip setting based on manufacturer's fault current and coordination analysis or as directed by Engineer.

3.2 GROUNDING

- A. Install the generator as a separately derived system. Ground the generator neutral to the generator frame. Ground the generator frame to the building grounding system and provide a driven ground electrode at the generator location.

3.3 CONTROLS

- A. Provide generator start-up control wiring and raceway from each automatic transfer switch to the respective standby generator set as required.

3.4 TESTING

- A. Testing shall be witnessed by owner and Engineer.
- B. Provide testing in accordance with NFPA 110. Upon completion of installation of engine-driven generator set and after building circuitry has been energized with normal power source. Provide manufacturer's start-up service to test emergency power system to demonstrate standby capability and compliance with specified requirements, including automatic start-up, controls and full load acceptance. Test shall include operation of standby power system with voltage check while the system is loaded to ensure proper operation of the emergency generator, transfer switches, and other system components. Operation of the system shall simulate standby power conditions, that is, loss of main electrical power to the building. Test period shall be trouble-free operation with at least four automatic transfer switch operations (each switch) within the period of operation.
 - 1. The unit shall be started and run for 30-minute break-in period at no-load unless recommended otherwise by manufacturer.
 - 2. The unit shall be started cold and run for a four-hour test with building load connected and load bank to achieve 90 percent of rated generator capacity. Monitor and record available natural gas pressure and verify supply is adequate and stable during the entire test.
 - 3. Retransfer the load after test.
 - 4. After this test, the set shall cool for five minutes, then must start and carry 90% rated capacity load for four hours.
 - 5. Demonstrate the cranking cycle and all engine safety devices. The Owner's authorized representative shall be instructed in the operation and maintenance of the unit. Provide minimum 4-hours training at each campus for 4-persons
- C. Contractor shall furnish all instruments, load banks, and personnel required for test. Submit 4 copies of certified test results to Architect/Engineer for review. Test reports shall include date and time of test, relative humidity, temperature and weather conditions.

3.5 MISCELLANEOUS

- A. Mount annunciator alarm as directed by Owner / Architect. Coordinate final location of ATS with Owner / Architect prior to installation.

3.6 PROGRAMMING

- A. Program automatic transfer switches for delayed transfer to emergency and sequential operation to transfer loads by priority based on manufacturer recommendation or as indicated below:
 - 1. Life Safety Loads – less than 10 seconds
 - 2. Critical Loads – more than 15 seconds, less than 30 seconds
 - 3. Equipment Loads – more than 40 seconds, less than 60 seconds
 - 4. Non-Legally required loads – more than 75 seconds, less than 120 seconds
- B. Program automatic transfer switch voltage and frequency pick-up and drop out for load shedding based on load priority for voltage and frequency based on manufacturer recommendations or as indicated below:
 - 1. Life Safety pick-up 10%; drop out 20%
 - 2. Critical Loads pick-up 10%; drop out 15%
 - 3. Equipment Loads pick-up 8%; drop out 15%
 - 4. Non-Legally required loads pick-up 5%; drop out 10%
 - 5. Program test button to transfer load.
 - 6. Program exerciser for no-load.

3.7 TRAINING

- A. Provide 4 hours training, one hour each for four persons, four separate days.

END OF SECTION

SECTION 26 51 13

LIGHTING FIXTURES AND LAMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work Included: Lighting fixture work is as shown, scheduled and specified.
- B. Applications: The applications of lighting fixtures required for the project include the following:
 - 1. General lighting
 - 2. Emergency lighting
 - 3. Outdoor area lighting

1.2 QUALITY ASSURANCE

- A. Provide interior building LED fixtures that comply with the Design Lights Consortium (DLC) standards and are DLC listed as a Qualifying Product at time of proposal submittal date.
- B. UL Standards: Lighting fixtures shall conform to applicable UL standards, and be UL or ETL labeled.
- C. Light fixtures shall conform to the requirements of NFPA 101, and 70 (NEC).

1.3 SUBMITTALS

- A. Submit product data for light fixtures, and emergency lighting equipment, including generator transfer devices.
- B. Specification Compliance Review: Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by manufacturers shown or scheduled for each type of lighting fixture. Refer to drawings for approved light fixture manufacturers.
 - 1. Emergency Battery Packs:
 - Bodine
 - IOTA
 - Chloride
 - Lithonia
 - Dual Lite
 - 2. Emergency Generator/Inverter Load Control Bypass Relay; UL924 listed and 0-10Vdc compatible:
 - Bodine
 - Wattstopper
 - Hubbell
 - Iota
 - Nine 24, Inc.
 - 3. Emergency Generator / Inverter Branch Circuit Transfer Switch, UL 1008 listed and 0-10Vdc compatible:

Bodine GTD20A
ETC SC1008

2.2 MATERIALS AND COMPONENTS

- A. General: Provide lighting fixtures of the size, type, and rating indicated, complete with, but not limited to, lamps, lamp holders, reflectors, ballasts, starters, and wiring.
- B. Fixture Types:
 1. General:
 - a. Lay-in troffer fixture panel type lenses, where specified, shall be extruded virgin acrylic, prismatic type minimum 0.125" thick, 7.8-ounces per square foot minimum.
 - b. Fixtures in continuous rows shall be supplied with fixture couplings, chase nipples, and accessories recommended by the manufacturer for continuous row installation.
 - c. Safety chains and wire guards at fixtures in mechanical and electrical rooms, and high abuse areas.
 - d. Fixtures located outdoors, in interior unconditioned spaces, and in wet locations shall be of aluminum construction.
 - e. Fixture door frame shall be of aluminum construction, white finish where located in kitchens, food prep areas, toilets, restrooms, locker rooms, dressing rooms, showers, and unconditioned spaces.
 - f. DLC or Energy Star qualified unless specified otherwise.
 - g. Minimum 5-year replacement warranty for driver and light engine.
 - h. Outdoor fixtures shall include a discrete / replaceable surge suppression device in addition to the surge suppression incorporated in the LED driver.
 - i. Operating temperature rating shall be between -40 degrees F and 120 degrees F.
 - j. Color Rendering Index (CRI): ≥ 80 Indoor; ≥ 65 Outdoor
 - k. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).
 2. Downlight Fixtures: Provide recessed downlight fixtures with trim rings compatible with the ceiling material where fixture is to be installed. Downlight fixtures shall have a minimum efficiency of 65-percent and exhibit "lamp before lamp image" 45-degree cutoff for ceiling up to 10 feet.
 3. LED Exit Signs: The exit lighting fixtures shall meet the requirements of Federal, State, and Local Codes.
 - a. Gymnasiums, locker rooms, athletic/PE wing and associated corridors, black box theaters, auditorium stages, cafeteriums and kitchens: Vandal resistant, wet location cast aluminum with polycarbonate protective cover exit signs, Lithonia Extreme Series.
 4. Emergency Lighting Units: Lead Calcium batteries with self-diagnostics. Provide full light output at 90 minutes of battery operation. LED lamps.
- C. LED drivers:
 1. NEMA 410 compliant for in-rush current.
 2. Drivers shall have a minimum efficiency of 85%.
 3. Starting Temperature: -40° F [-40° C].
 4. Input Voltage: 120 to 480 ($\pm 10\%$) V.
 5. Power Supplies: Class I or II output.
 6. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50 μ s, 10kA/8 x 20 μ s) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.

7. Power Factor (PF): ≥ 0.90 .
 8. Total Harmonic Distortion (THD): $\leq 20\%$.
 9. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
 10. Drivers shall be reduction of hazardous substances (ROHS)-compliant.
- D. Voltage: Equipment for use on 120V systems shall be suitable and guaranteed for voltage range of 100V to 130V. Equipment on 277V systems shall be suitable and guaranteed for voltage range of 225V to 290V. Universal voltage equipment shall be suitable and guaranteed for a voltage range of 100V to 290V.
- E. Light fixture housing for exterior use: Provide aluminum or stainless housing. Where stainless steel hardware is used, both male and female fasteners shall be stainless steel.
- F. Emergency LED battery self testing drivers and inverters; 5 year warranty.
1. Bodine BSL-ST Series for OEM installation
 2. Bodine BSL310-SI Series for field installation
 3. Bodine ELI-S Series for line voltage sine wave inverter field installation
- G. Emergency Battery Packs – Exit Signs: Nickel Cadmium battery with self- diagnostics; Minimum 3-year non-prorated replacement warranty.
- H. Emergency Generator / Inverter Load Control Device:
1. 16 Amp minimum ballast / driver load
 2. Compatible with 0-10 Volt dimmer switches
 3. UL 924
 4. Minimum 3-year warranty
 5. Integral or remove test switch.
- I. Emergency Generator / Inverter branch circuit transfer switch:
1. UL 1008
 2. 20 Amp ballast/driver load
 3. 0-10Vdc dimming compatible

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install lighting fixtures of the types indicated, where shown, and at indicated heights in accordance with the fixture manufacturer's written instructions and industry practices to ensure that the fixtures meet the specifications. Fixtures shall fit the type of ceiling system scheduled.
- B. Standards: Comply with NEMA standards, applicable requirements of NEC pertaining to installation of interior lighting fixtures, and with NECA Standard of Installation.
- C. Attachment: Fasten fixtures to the indicated structural support members of the building. Provide four separate wire supports for recessed ceiling mounted lighting fixtures, one at each corner of fixture. Check to ensure that solid pendant fixtures are plumb. Provide T-bar locking clips on all four sides for lay-in fixtures.
- D. Coordination: Field coordinate and locate lighting fixtures in open ceiling areas including mechanical and electrical rooms so that light is not obstructed by piping, ductwork, etc. Locate light fixtures in front of electrical and mechanical equipment to provide adequate illumination for testing and maintenance. Relocate installed light fixtures as directed by Owner / Architect at no additional cost.
- E. Final adjustment of all aimable exterior light fixtures shall be in coordination with, and to the satisfaction of, the Owner's designated representative. Pre-aim all fixtures prior to scheduled final aiming and adjustment with Architect / Owner. Verify that all rotatable optics are in their

proper orientation prior to final aiming.

- F. Provide vandal resistant exit signs without wire guards in all physical education and athletic sports areas, including egress corridors adjacent to these areas, black box theaters, auditorium stages, vocational shops, cafeteriums and kitchens.
- G. Provide exit sign directional arrows as required. Provide a minimum of two and a maximum of 10% spare exit signs to be installed as directed by Architect.
- H. Install in accordance with manufacturers instructions.
- I. Install suspended luminaries using pendants supported from swivel hangers. Provide pendant length required to suspend luminary at indicated height.
- J. Locate recessed ceiling luminaries as indicated on the Architectural reflected ceiling plan.
- K. Install surface mounted luminaries plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- L. Exposed Grid Ceilings: Support surface mounted luminaries on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling Ts to support surface mounted luminaries. Fasten surface mounted luminaries to ceiling T using bolts, screws, rivets, or suitable clips.
- M. Install recessed luminaries to permit removal from below.
- N. Install recessed luminaries using accessories and fire stopping materials to meet regulatory requirements for fire rating.
- O. Install wall-mounted luminaries at height as directed by Architect.
- P. Install accessories furnished with each luminary.
- Q. Connect luminaries to branch circuit outlets using flexible conduit as specified.
- R. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaries.
- S. Bond products and metal accessories to branch circuit equipment grounding conductor.
- T. Provide emergency transfer devices for light fixtures powered by generator or inverter emergency lighting circuits which are used for normal lighting and to be switched with the switched normal lighting circuit in the same room, corridor or area.
- U. Provide un-switched, constant-hot circuit to all battery powered emergency lighting equipment and emergency transfer devices (GTD). Where normal light fixture circuit is switched or contactor controlled, non-switched battery charging or GTD circuit shall originate from same branch circuit breaker as switched lighting circuit.
- V. Provide emergency powered light fixture in front of all electrical switchgear, including but not limited to panelboards, switchboards, motor control centers, low voltage control panels, transfer switches, motor controllers and disconnect switches.
- W. Provide emergency battery operated light fixtures at all transfer switch locations and at all central battery emergency lighting inverters.
- X. Provide automatic controls for exterior light fixtures. Exterior building mounted light fixtures shall be circuited through lighting contactors. Lighting contactors shall be controlled by the Building Management System. Where no building management system is provided or

specified, provide time clock switches, photocells, photosensors as specified, and required by the local energy codes.

- Y. Lighting contactors shall not be installed above ceiling and shall be readily accessible, located in same room as panelboard serving load.
- Z. Wall mounted light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable. Where wall mounted fixtures attach to junction box only, firmly secure junction box to adjoining studs in wall.
- AA. Lighting Fixture Supports:
 - 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction to the structural slab or to structural members within a partition, or above a suspended ceiling.
 - 2. Shall maintain the fixture positions after cleaning and relamping.
 - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
- BB. Hardware for surface mounting fixtures to suspended ceilings:
 - 1. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
 - 2. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4 inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4 inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

3.2 TESTING

- A. General: Upon installation of lighting fixtures, and after building circuits are energized, apply electrical energy to demonstrate proper operations of lighting fixtures, emergency lighting, and controls. When possible, correct malfunctioning units at the site, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting.
- B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including plastics and glassware, adjust trim to fit adjacent surfaces, replace broken or damaged parts, and lamp and test fixtures for electrical and mechanical operations. Any fixtures, or parts of fixtures that show signs of rust or corrosion at the time of completion, shall be removed, and replaced with protected metal parts.
- C. Final aiming and Adjustment: Aim and adjust aimable and adjustable lighting fixtures for their intended purpose. Re-aim and re-adjust as required to the satisfaction of the Architect / Owner, including nighttime adjustment of exterior lighting in the presence of the Architect / Owner.

END OF SECTION

SECTION 281500.30 – MULTI-FAMILY DATA-ON-CREDENTIAL ACCESS CONTROL 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 the following:

1. System operation and credential encoding system.
2. Online door controller system.
3. Mobile configuration application.
4. Electromechanical resident room locks.
5. Electromechanical common area locks.
6. Credential enrollment station.
7. Cloud based access control system application software.
8. Access credentials.

- B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 01 Section "Closeout Procedures".
3. Division 08 Section "Door Hardware Schedule".
4. Division 08 Section "Hollow Metal Doors and Frames".
5. Division 08 Section "Flush Wood Doors".
6. Division 08 Section "Automatic Entrances".
7. Division 08 Section "Door Hardware".
8. Division 08 Section "Automatic Door Operators".
9. Division 11 Section "Parking Control Equipment".
10. Division 14 Section "Elevators".
11. Division 26 Section "Electrical".
12. Division 28 Section "Access Control Hardware".

- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 80 - Fire Doors and Windows.
4. NFPA 101 - Life Safety Code.
5. NFPA 105 - Installation of Smoke Door Assemblies.
6. FCC Part 15 Subpart C.
7. State Building Codes, Local Amendments.

- D. Standards: All hardware specified herein shall comply with the following industry standards:
1. ANSI/BHMA Certified Product Standards - A156 Series
 2. UL10C – Positive Pressure Fire Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. System Operational Descriptions: Complete system operational narratives for the integrated access-controlled openings defining the owner's prescribed requirements for the opening functionality. Narratives include, but are not limited to, the following situations: normal secured/unsecured state of door; authorized access; authorized egress; unauthorized access; unauthorized egress; fire alarm and loss of power conditions, and interfaces with other building control systems.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access-controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 2. Electrical Coordination: Coordinate with related Division 26 Electrical Sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized provider of the primary access control components.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware and site management installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.
- F. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Inventory components upon receipt and provide secure lock-up and shelving. Do not store electronic locks, software or accessories at Project site without prior authorization.
- B. Tag each lockset or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service.

1.5 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing electrified door hardware and access control system components.
- B. System Survey: Prior to ordering the system, review the construction documents to determine the correct number and locations of stand-alone locks and wired devices if possible.
 - 1. Data-on-Credential applications that require physical credentials are supported by online updaters.
- C. Electrical Connections: Coordinate the layout and installation of scheduled electrified door and related access control equipment with required connections to source power junction boxes, low voltage power supplies and Power over Ethernet switches as applicable.

1.6 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 3. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. nexTouch NTB600 Series Cylindrical Lock: 3-year electrical, 3-year mechanical, 1-year finish.

2. nexTouch NTM600 Series Mortise Lock: 3-year electrical, 3-year mechanical, 1-year finish.
3. nexTouch NTT600 Series Electrified Trim for Rim Exit Device: 3-year electrical, 3-year mechanical, 1-year finish.
4. NTD600 Series Deadbolt Lock: 1-year electrical, 3-year mechanical, 1-year finish.
5. NTD600 Series Interconnected Lock: 1-year electrical, 3-year mechanical, 1-year finish.
6. NTX-600-KIT Updater/Controller: 1-year electrical.
 - a. NTX600-CTRL: 1-year electrical.
 - b. HID R10BLE, R40BLE, SE SEOS BLE Readers: limited lifetime electrical.

1.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed by certified integrator for continued adjustment, maintenance, and removal and replacement of system components.

1.8 SCOPE OF WORK

- A. Access Control Site Management System: Furnish and install at the indicated locations the specified integrated access control door hardware and access control system firmware and software for a completely operational access control. System includes, but is not necessarily limited, to the following:
 1. Electrified integrated access control locks, network switches, updaters, door position switches, remote credential updaters, keypads, access credentials, system application software and mobile configuration device application, special tools, operating manuals, and required cabling and accessories as detailed below and listed in the Access Control Hardware Sets at the end of Part 3.
 - a. Provide manufacturer approved integrated access control locks, exit hardware, and remote mounted credential updaters and keypads that are functionally compatible with the specified access control equipment interfaces.
- B. Owner to provide the following:
 1. Internet accessible devices that support current browser software.
 2. Compatible mobile devices that run an Android OS and offer NFC (Near Field Communication) capabilities, thus capable of accepting the mobile configuration application.
 - a. For offline lock and online updater configuration: Mobile device to run an Android OS and offer NFC (Near Field Communication) capabilities, thus capable of accepting the mobile configuration application.
 - b. For mobile access to offline lock and online updaters: Bluetooth Low Energy (BLE) capable IOS or Android mobile device with internet connection to download the ASSA ABLOY ACCENTRA Access mobile application.

3. Power Sourcing, Network Switches, Power over Ethernet: Quantity as required to accommodate installed access control devices.
4. Network Control Connections: LAN/Ethernet communication ports (jacks) and network interface cards as needed, CAT5e (CAT6) cabling from network router/switch to networked updater, outlet and cover plates and/or patch cables required for network connection.
5. Power Supplies, including battery or uninterrupted backup power supply (UPS) and separately fused surge protection, required for the electrified door hardware, access control equipment, and PoE switches or wireless routers driving the integrated credential reader locking devices.
6. Installation, final configuration and commissioning of electrified door and access control system hardware, power supplies and related accessories.
7. System application and cloud services and mobile application including installation, programming, and end user training of the access control system and mobile access applications demonstrating operating, repair, and maintenance procedures.

C. Electrical contractor, Division 26, to provide the following:

1. Source power wiring (120VAC) as required for the integrated locking and access control hardware, equipment, accessories and power supplies. This includes quad outlets as required on a dedicated circuit and the related conduit, stub-in, junction boxes and connectors required for the source power delivery and connections.
2. Provide required conduit, stub-in, junction and back boxes for both the electrified locking hardware and access control equipment at each of the access controlled or monitored openings per plan drawings and specs. Supply and install conduit between each of the aforementioned devices and between the electrical junction boxes, power supplies and access control equipment located on or above the door opening.
 - a. At wall mounted updaters, provide conduit on the secured side of the door, 36" from the finish floor and 6" from the edge of the frame, to the related power supplies and access control equipment.
 - b. At electrical hardware power transfers provide conduit on the secured side of the opening from the power transfer, thru-wire hinge, or serviceable panel location on the frame jamb to the related power supplies and access control equipment.
3. Electrical Contractor to provide all 120VAC cabling connections and terminations from the electrical junction boxes to these electrical devices.

D. Access Control System Integrator to provide the following:

1. Low voltage wiring (12/24VDC) and communication cabling (RS-485) to support controllers, relays, and electrified locking devices and door operators to updaters and power supplies. Work includes related connectors, final terminations, and hook-ups required for a complete and functional access controlled opening in accordance with applicable codes and specified system operational narratives.

- a. Provide size appropriate spacers for updaters mounted against metal surfaces.
- E. Elevator Contractor to provide the following:
1. Interface or landing of interface cable onto the elevator call button will be performed by a certified elevator contractor.
 2. Coordinate with certified integrator provisions for a credential reader with output allowing the elevator call button to be activated. A validated credential reader and updater will be required for activation.
- F. Final connections to fire alarm system, if required, by electrical and fire alarm system contractors.
1. Provide permits, submittals and approvals required by the authority having jurisdiction, prior to commencing with work.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
- C. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 ACCESS CONTROL EQUIPMENT AND SYSTEM FEATURES

- A. System: System is cloud based and supports all major browsers.
 1. Client Requirements:
 - a. Internet Browser: Firefox, Chrome, Internet Explorer, Edge or similar.
 - b. Internet access.
 2. System Features:
 - a. 5,000 unique user credentials.

- b. Ability to grant residents limited administrative rights to manage visitors/guests themselves via their mobile application and/or web interface.
 - c. Unlimited credential updaters (with door control).
 - d. User-definable schedules and revalidation periods.
 - e. Unlimited user-definable access for authorized users to system services.
 - f. Unlimited provisioning of mobile credentials for system users.
 - g. Remote and schedule unlock for online door controllers.
 - h. Remote reboot and remote firmware upgrade of online controllers.
 - i. Access permissions with start and end dates and times for credential holders.
 - j. User definable emergency one-time-PIN code issuance for offline locks.
 - k. Unlimited cloud accessible audit history.
 - l. Visibility of online status of online openings.
 - m. System export capabilities to .CSV file format.
- B. Mobile Configuration Application: Provide a configuration application which is compatible with Android 5.0 or later and offers NFC (Near Field Communication) capabilities.
 - 1. Configures time, date and system association for both offline locks and online updaters.
 - 2. Assigns unique identities to all devices within the system.
 - 3. Communicates lock information- lock type and firmware version to the cloud service.
 - 4. Displays locally retrieved audit trail from offline locks.
 - 5. Controls local lock settings and master code.
 - 6. Resets offline locks to factory default.
 - 7. Offline lock firmware upgrade over the air via NFC or BLE.
- C. Mobile Access Application: For residents and staff who desire to use a mobile device to access offline locks and/or online updaters- must have internet connectivity to receive the mobile credential and the device must be either Android 5.0 or IOS 13.
 - 1. Stores SEOS credential in secure element of the mobile device.
 - 2. Revalidates mobile credential when an internet connection is established.
 - 3. Communicates access privileges to both offline locks and online openings.
 - 4. Provides positive visual, and optional audible, and vibratory feedback about the status of credential transaction in real time.
 - 5. Ability to grant residents limited administrative rights to manage visitors/guests themselves via their mobile application and/or web interface.
 - 6. Communicates transaction information to the cloud when an internet connection is established.
- D. Offline System Operation: This facility will operate with offline lock access control of common area and resident doors. Updates are provided to the physical credential by presentation to the online updater after updates in the cloud system which may be operating as either a door controller or as an enrollment station. Updates are provided to the mobile credential “over the air” via an active internet connection.
- E. The facility will operate with the control of online updaters if physical credential access is required. If only mobile access is required, the facility may optionally operate without the control of online updaters.
- F. Manufacturers:

1. ASSA ABLOY ACCENTRA (YA) - Data-on-Credential compatible with the ASSA ABLOY Multi-Family Access Management Software System.

2.3 SYSTEM COMPONENTS AND TECHNOLOGY

- A. The system shall provide the ability for online operators to operate as online doors for the purposes of both access control and encoding/updating credentials. Provide the necessary network and lock components to create an online lock control system at the perimeter of the building. Utilize standard Ethernet and Power over Ethernet (PoE) as the communication backbone between the system server and the wired (on-line) doors and updaters.
- B. Functionality:
 1. Online updaters must function as an offline locking system by continuing to grant access to authorized users if online communication is interrupted but continuous power is still applied.
 2. Must provide real-time control of online updaters and access privileges of individual users from a central or remote location.
 3. Must allow resident and staff credentials to be changed, extended, or revoked from cloud system. Resident credentials are automatically revoked upon move-out or expiration of a lease and allowable access timeframe.
 4. Credential holders shall be able to obtain a one-time PIN code from the systems software with proper authorization by the site administrator for emergency access to offline locks.
 5. Must be possible to display access audit trails, low battery events, and system access in the cloud system. Additionally, audit trails from offline locks must be visible from the mobile configuration application via local lock retrieval.
 6. Must be possible to issue multiple mobile and physical credentials per user.
- C. Lock Communication: Provide locks with RFID and BLE read/write capabilities to provide the communication link between the system server and the lockset over data-on-credential transport mechanism.
- D. Credential Updaters/Controller combination: Provide R10/40 OSDP SE BLE Updaters compatible with: ISO 14443A. Provide system capable of supporting an unlimited number of online updaters acting as single door controllers and/or credential enrollment stations. Controller directly connects into the LAN/WAN network, using DHCP, DNS and TCP/IP addressing. Controller can be powered by PoE switches (specified in the electrical section), or by a 24VDC power supply. Controller shall offer a manual configuration lock option to prevent unauthorized configuration of the online updater.

2.4 DATA-ON-CREDENTIAL ACCESS CONTROL LOCKS

- A. Data-on-Credential Access Control Deadbolts: ANSI/BHMA A156.36, Series 4000, Grade 2 deadbolt with integrated keypad for access and programming. Listed manufacturers shall meet all functions and features as specified herein.
 1. Provide deadbolts with functions and features as follows:
 - a. Fully encrypted AES 128 NFC and BLE wireless communication between lock and SEOS® credentials.
 - b. Capacitive touchscreen.
 - c. Voice guided (English, French or Spanish) programming and master PIN code for security.
 - d. Motorized locking and unlocking.
 - e. Unlockable via key, one time PIN code and/or card, fob, mobile credential, interior thumbturn.
 - f. Firmware upgradable over the air via configuration application.
 - g. Audit trail with 200 locally retrievable and unlimited cloud management events.
 - h. Optional modes: privacy, wrong-try shutdown, escape return, passage.
 - i. Powered via 4AA batteries, external 9VDC regulated power supply, or 9VDC transistor battery backup terminal at keypad (emergency).
 2. Manufacturers:
 - a. ASSA ABLOY ACCENTRA (YA) - NTD600-ACC Series.

2.5 ONLINE CREDENTIAL UPDATERS/DOOR CONTROLLERS

- A. Contactless smart credential updaters to securely read information from and write access control data to 13.56 MHz contactless RFID smart credentials. The contactless smart credential updater is designed for use in the Accentra Access Control system by providing:
 1. Secure access control data exchange between the credential and the updater utilizing key diversification and mutual authentication routines.
 2. Contactless smart credential updater to be designed for low current operation to enable migration from most legacy proximity applications without the need to replace existing electrified door hardware, wiring and/or power supplies.
 3. Updater product construction suitable for both indoor and outdoor applications.
 4. Updater available with either pig tail or terminal block wiring options.
 5. Updater available in either mini-mullion or wall switch form factor.
 6. Manufacturers (13.56 MHz iCLASS):
 - a. ASSA ABLOY ACCENTRA (YA) - NXT 610BLE/640BLE (as specified).

2.6 CREDENTIALS

- A. Provide secure RFID credentials that meet NIST requirements for encryption and HIPAA requirements for patient information security as required by the access control system specified

herein. Credential technology shall provide protection against surreptitious tracking of the credential by means of random Credential Serial Number (CSN) generation. Credentials shall additionally provide a second layer of anti-cloning encryption to eliminate credential duplication. Physical credentials are to be capable of resisting tearing, bending, scratching, and moisture.

- B. Contactless Smart Card Credentials: Card credentials incorporating an access control identification technology that utilizes 13.56 MHz radio frequency (RF) circuits in microchip form. The microchips are encoded and securely transmit the encoded information when activated.
 1. Technology features:
 - a. Available in 8K-Bytes.
 - b. AES-128 bits cryptographic algorithms for data protection.
 - c. Hardware chip integrating co-processor with high performance for cryptographic calculations with symmetric keys.
 2. Security features:
 - a. Programmable with one or several Secure Identity Objects® (SIOs®) for each application.
 3. Card credential technology contactless features:
 - a. Tri-technology: 13.56MHz credential supports Accentra offline iCLASS SEOS and PACS online iCLASS SEOS technologies with 8K memory and 125kHz 26-bit proximity.
 4. Interoperability:
 - a. Fully supported by iCLASS SE® and multiclass SE® readers that can process SIO-enabled data formats. PACS online only supported by iCLASS SE readers with firmware Revision E or later.
 5. Quantity: Include three per resident room. Coordinate additional credential quantities with the facility manager.
 6. Manufacturers (13.56 MHz iCLASS SEOS):
 - a. ASSA ABLOY ACCENTRA (YA) - NTX600-YALPRX-8K.
 - b. No Substitution.
- C. Key Fobs: Fobs incorporating an access control identification technology that utilizes 13.56 MHz radio frequency (RF) circuits in microchip form. The microchips are encoded and securely transmit the encoded information when activated.
 1. Technology features:
 - a. Available in 8K-Bytes.
 - b. AES-128 bits cryptographic algorithms for data protection.

- c. Hardware chip integrating co-processor with high performance for cryptographic calculations with symmetric keys.
2. Security features:
 - a. Programmable with one or several Secure Identity Objects® (SIOs) for each application.
3. Fob technology features:
 - a. 13.56MHz FOB supports Accentra offline iCLASS SEOS and PACS online iCLASS SEOS technologies with 8K.
4. Memory interoperability:
 - a. Fully supported by iCLASS SE® and multiCLASS SE® readers that can process SIO-enabled data formats. PACS only supported by iCLASS SE readers with firmware Revision E or later.
5. Quantity: Include three per resident room. Coordinate additional fob credential quantities with the facility manager.
6. Manufacturers (13.56 MHz iCLASS SEOS offline and online):
 - a. ASSA ABLOY ACCENTRA (YA) - NTX600-YALFOB-8K.
 - b. No Substitution.

2.7 ACCESS CONTROL READERS

- A. UHF Reader: Long-range RFID reader operating in the UHF spectrum capable of door control, user management, and access control. Manufacturer shall be ISO 9001 certified with a minimum of five years of experience in producing access control equipment. Listed manufacturers shall meet all functions and features as specified herein.
 1. Provide devices with functions and features as follows:
 - a. Compatible with EPC Global UHF Class 1 Gen 2/ISO 18000-6C tags and open API integration.
 - b. IP65 dust and waterproof protection.
 - c. TCP/IP, RS-485, Wiegand IN and OUT, Relay NO/NC, USB with adjustable RF output power.
 - d. Reading distance up to 15 meters.
 - e. Twelve-month limited warranty.
 2. Manufacturers:
 - a. Control ID (CI) - iDUHF.

2.8 FABRICATION

- A. Fasteners: Provide system components manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.9 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with requirements for installation tolerances, labeled fire door assembly construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of products including but limited to: front desk equipment and software, remote controllers, electromechanical exit devices, and unit room locks.
- B. Storage: Provide a secure lock up for materials delivered to the project but not yet installed. Control the handling and installation of items so that the completion of the work will not be delayed by material losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating unit and each door lock to ensure proper operation. Replace units that cannot be adjusted to operate as intended.

3.6 CLEANING AND PROTECTION

- A. Protect all components stored on construction site in a covered and dry place. Protect installed components during the construction phase. Install components at the latest possible time frame.
- B. Clean components as necessary to restore proper finish. Provide final protection and maintain conditions that ensure components are without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner’s managerial personnel on the correct use of the online updater, configuration application for the purpose of lock updates for time after battery changes, and cloud service components.
- B. Instruct Owner’s managerial personnel on the location and navigation of the cloud service and configuration application user manuals in the cloud service.
- C. Instruct Owner's maintenance personnel to adjust, operate, and maintain electromechanical door hardware.

3.8 DOOR HARDWARE SCHEDULE

- A. Refer to Section 080671, Door Hardware Schedule, for hardware sets.
- B. Manufacturer’s Abbreviations:

END OF SECTION 281500.30

SECTION 281523 - INTERCOM ENTRY SYSTEMS

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 multi-tenant video intercom entry systems and related products.
- B. Related Sections:
 - 1. Division 01 Section “Closeout Procedures”.
 - 2. Division 28 Section “Security Access Detection Equipment”.
 - 3. Division 28 Section “Security Video Intercom System”.
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- D. Codes, References and Standards:
 - 1. American National Standards Institute (ANSI/TIA/EIA) 568 - Commercial Building Telecommunications Cabling Standard.
 - 2. International Organization for Standards (ISO) 9001:2000 - Quality Management Systems - Requirements.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including Preparation instructions and recommendations, storage and handling requirements and recommendations and installation methods.
- B. Shop Drawings: Submittals to include wiring diagrams indicating wiring for each item of equipment and interconnections between items of equipment. Include manufacturer's names, model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
- C. Installation and Operation Manuals: Submit manufacturer's installation and operation manual, including operation instructions and component wiring diagrams. Provide detailed information required for Owner to properly operate equipment.
- D. Warranty: Submit manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage a qualified manufacturer that is an ISO 9001 (2008) certified company.
- B. Installer Qualifications: Factory trained and experienced with system installations of scope and size required for the Project.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- C. Protect materials during handling and installation to prevent damage.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.1 INTERCOM ENTRY STATIONS

- A. Door Stations (Multi-Tenant, Large Occupancy): Modern, rectangular surface or flush mounted IP video door stations for multi-tenant residences and buildings with up to 1000 units.
 - 1. Provide door stations with the following functions and features:
 - a. App configurable QR code reader with individual codes for access control.
 - b. Night vision with infrared LEDs and light sensor.
 - c. Ultra-bright 7" touch display that can be operated in wet conditions.
 - d. Motion sensor with 4D technology.
 - e. Bluetooth Low Energy (BLE) compatible with Bluetooth keyfob.
 - f. Configurable RFID reader.
 - 2. Manufacturers:
 - a. DoorBird (DR) - D31 Series.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive integrated security and communication system and notify architect of conditions that would adversely affect installation or subsequent use. Do not begin installation until unacceptable conditions are corrected.

3.2 PREPARATION

- A. Verify the following compliance before starting installation.
 - 1. All units, except for the entrance station and tenant station, are designed for indoor use only.
 - 2. The unit turns inoperative during power failure.
 - 3. In areas where broadcasting station antennas are close by, intercom system may be affected by radio frequency interference.
 - 4. Keep the intercom wires at least 1 foot away from strong electrical wiring including wiring for inverter electrical appliances; noise and malfunction could result.
 - 5. Keep the unit more than 3.3 feet away from radio or TV set.
 - 6. If a strong light shines on the main unit screen, the picture will turn white or only silhouettes will be visible.
 - 7. Other manufacturer's devices (such as sensor, detectors, door releases) used with this system, comply with the manufacturer's installation requirements.

3.3 INSTALLATION

- A. Install integrated security and communication system in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Mount equipment plumb, level, square, and secure. For video entrance stations and video door stations, comply with manufacturer's design requirements to provide optimum picture quality of station monitoring.

3.4 SETUP AND ADJUSTING

- A. Adjust integrated security and communication system for proper operation in accordance with manufacturer's instructions.

3.5 DEMONSTRATION AND TRAINING

- A. Demonstrate that integrated security and communication systems function properly.
 - 1. Perform demonstration at final system inspection by qualified representative of manufacturer.
- B. Provide instruction and training of Owner's personnel as required for operation of integrated security and communication system.

- C. Provide hands-on demonstration of operation of system components and complete system, including user-level program changes and functions.
- D. Provide instruction and training by qualified representative of manufacturer.

3.6 PROTECTION

- A. Protect installed integrated security and communication system from damage during construction.

END OF SECTION 281523

SECTION 28 31 00

FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Provide all detailed engineering, documentation, materials and devices, installation, calibration, software programming and check-out necessary for a complete and fully operational fire detection and alarm system in accordance with the full intent and meaning of the drawings and specifications including, but not limited to, the following:
 - 1. Supply, install and connect all hardware necessary to provide a complete and operational fire detection and alarm system.
 - 2. Supply, install and wire all field hardware, fire alarm control panel, power supplies, power circuits, alarm initiating devices, audible and visual alarm devices, auxiliary control relays, signal initiating and signaling devices, conduits, wires, fittings and all accessories required for the system to perform as specified as required.
 - 3. Supply, install, debug and test all software required to provide all software functions described in accordance with the full intent and meaning of the drawings and specifications.
 - 4. Coordinate the work specified under this Section with other trades and contractors to assure a complete and fully operational system.
- B. The intent of fire detection and alarm system work is specified in this section and indicated on the drawings. The installing contractor shall design and provide a complete system, meeting the requirement of this specification. The Contractor shall provide all fire alarm and initiation devices required for a complete system acceptable to all governing authorities. Provide proper spacing and coverage of all devices.

1.2 RELATED SECTIONS

- A. Division 22 and Division 23
- B. Sprinkler Systems
- C. Elevators

1.3 CODES / STANDARDS / REFERENCES (LATEST EDITIONS)

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 13 Systems, Installation
 - 2. NFPA 17 Dry Chemical Extinguishing Systems
 - 3. NFPA 70 National Electrical Code
 - 4. NFPA 72 National Fire Alarm and Signaling Code.
 - 5. NFPA 80 Fire Doors and Fire Windows
 - 6. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
 - 7. NFPA 92A Smoke Control Systems
 - 8. NFPA 101 Life Safety code.
 - 9. NFPA 105 Smoke Control Door Assemblies
 - 10. NFPA 2001 Fire Extinguishing Systems, Clean Agent
- B. UL: Underwriters Laboratories, Inc.
 - 1. 217 Single and Multiple Station Smoke Detectors.
 - 2. 268 Smoke Detectors for Fire Protective Signaling Services.
 - 3. 864 Control Units for Fire Protective Signaling Services, 9th Edition.
 - 4. 864 Transient protection
 - 5. 1480 Speakers for Fire Protective Signaling Systems

- 6. UL Fire Protection Equipment Directory.
- 7. UL Electrical Construction Materials Directory.
- C. Uniform Federal Accessibility Standards (UFAS).
- D. Factory Mutual P7825 Approval Guide
- E. American National Standards Institute (ANSI).
- F. National Electrical Manufacturer's Association (NEMA).
- G. Institute of Electrical and Electronic Engineers (IEEE).
- H. Electronic Industries Association (EIA-232-C): Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.
- I. Requirements of American Disabilities Act (Public Law 101-336).
- J. Local Accessibility Standards
- K. State Fire Marshall or Requirements of Local Authorities having Jurisdiction
- L. State Insurance Code
- M. International Building Code Adopted by Local Authority Having Jurisdiction
- N. Local & State Building Codes
- O. In addition the above requirements, comply with all local codes. Where discrepancies exist between codes, drawings or specifications, the more stringent requirement shall prevail. Installation shall be subject to approval, inspection and test of applicable regulatory agencies.

1.4 MANUFACTURER'S, PLANNER'S AND INSTALLER'S QUALIFICATIONS

- A. The manufacturer shall regularly and presently produce, as the manufacturer's principle products, the equipment and material of the type and design specified for this project, and shall have manufactured the item for at least 5 years.
- B. Manufacturer's product shall have been in satisfactory operation on three installations of similar size, type and design as this project, for approximately 3 years.
- C. Manufacturer shall submit at the time of bid a list of installations where the products have been in operation.
- D. The installing contractor shall have been actively engaged in the business of designing, selling, installing, and servicing fire alarm systems for at least ten (10) years.
- E. The entire Fire Detection and Alarm System shall be installed by an authorized representative of the Fire Alarm Manufacturer and certified by the manufacturer to distribute, sell, and install the specified fire alarm and smoke detection system. Include all components, elements, and testing and acceptance procedures.
- F. If the submitted system is being supplied by an authorized distributor of the equipment manufacturer, the distributor shall have been actively engaged in the sale, installation and service of the type of system proposed for this project for a minimum of 10 years.
- G. Any proposed installer who cannot show evidence of such qualifications may be rejected. The services of a technician provided and certified by the equipment manufacturer shall be provided to supervise the installation and tests of the system.

- H. Furnish evidence there is an experienced and effective service organization, which carries a stock of repair parts for the system to be furnished.
- I. The installing contractor shall be licensed by the State Fire Marshall to design, sell, install, and service fire alarm systems as required by the State Insurance Code.
- J. The installing contractor shall have on his staff a minimum of two (2) Fire Alarm Planning Superintendent (APS) licensed by the State Fire Marshall's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the State Insurance Code.
- K. The APS shall be a certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place. In lieu of a NICET certified state licensed fire alarm planner, the contractor or supplier may provide design supervision by a registered professional engineer, who regularly engages in the design of fire alarm systems as required by the Texas Board of Professional Engineers.
- L. The installing contractor shall provide 24-hour, 365 days per year emergency service with factory trained, state licensed service technicians.
- M. Material shall be new and in perfect condition when installed.
- N. Electrical or electronic equipment provided under this Division which has been damaged, exposed to weather, or is, in the opinion of the Architect/Engineer otherwise unsuitable because of improper fabrication, storage, or installation, shall be removed and replaced with new equipment, at no additional cost to the owner.
- O. Quality Control Assurance:
 - 1. All components of the fire alarm system shall be products of an Underwriters Laboratories, Inc. listed fire alarm manufacturer, and shall bear the UL Label. Partial listing shall not be acceptable.
 - 2. All components of the fire alarm systems shall use the most current technology available.
 - 3. Only new parts shall be installed at the time of initial installation and to repair the system during the warranty period. No reconditioned parts shall be used.
 - 4. All devices shall be tested and certified that they meet or exceed the "Service Life Expectancy Rating" as outlined by UL and NFPA.

1.5 COORDINATION

- A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all other trades.
- B. Contractor shall schedule a pre-construction meeting with Owner/Architect regarding the Fire Detection and Alarm System.

1.6 DEFINITIONS

- A. General: Wherever mentioned in this specification or on the drawings, the equipment, devices and functions shall be defined as follows:
 - 1. Alarm Signal: A signal, which signifies a state of emergency requiring immediate action and immediate notification of the Fire Department. These are signals such as:
 - a. The operation of a manual station.
 - b. The operation of a fire suppression system switch.
 - 2. Pre-Alarm Signal: A signal, which indicates a detection device, has operated. These signals require an immediate response, but do not require immediate notification of the Fire Department.
 - 3. Supervisory Signal: A signal, which signifies the impairment of fire protection system, which may prevent its normal operation.

4. Trouble Signal: A signal, which indicates that a fault, such as an open circuit or ground, has occurred in the system.
5. Alarm Zone: An alarm initiating device or combination of devices connected to a single alarm initiating device circuit.
6. Pre-Alarm Zone: A detector or group of detectors connected to a single detector circuit, which can send an alarm to the central control panel.
7. Supervision Zone: A supervisory signal initiating device or combination of such devices connected to a single supervisory signal circuit.
8. Communication Zone: A fire alarm indicating device or series of devices arranged to visually and/or audibly indicate a fire alarm signal.

1.7 SUBMITTALS

- A. Contractor shall meet with Owner's Fire Alarm System representative prior to submission of formal/final shop drawings to Architect to allow the Owner and Architect to review a preliminary draft copy of the submittal to verify compliance with the specifications and any detailed requirements of the project. After the draft submittal has been reviewed by the Architect / Owner / Engineer, and formal shop drawings have been reviewed by Architect and returned to the Contractor, the required pre-construction meeting shall take place with Owner / Architect / Engineer.
- B. Before the final set of shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the authorities having jurisdiction (AHJ).
- C. All preliminary and as-built design drawings and supporting documentation shall include: Floor Plan Drawings, riser diagrams, control unit wiring diagrams, point to point wiring diagrams, and typical wiring diagrams as described herein.
 1. Name of Owner and Occupant
 2. Date
 3. Location, including street address.
 4. Provide a complete written, item-by-item, line-by-line, specification review stating compliance or deviation in full description.
 5. Device Legend
 6. Input/output programming matrix
 7. Licensed Designer Information – Registered Professional Engineer or Alarm Planning Superintendent (APS)
 8. Battery calculations
 9. Notification appliance circuit voltage drop calculations
 10. Floor Plan
 - a. Floor identification
 - b. Point of compass
 - c. Correct graphic scale
 - d. All walls and doors
 - e. All partitions extending to within 15 percent of ceiling height
 - f. Room descriptions
 - g. Fire alarm device / component locations
 - 1) Signal notification devices
 - 2) Initiation devices
 - 3) Smoke control systems
 - 4) Initiation of automatic extinguishing equipment
 - 5) Doors that unlock or close automatically
 - 6) Zone verification for detection devices
 - 7) Fire/Smoke damper control
 - 8) Fire alarm panel location
 - 9) Fire alarm annunciators
 - 10) Control valves to Fire Protection System
 - 11) Duct smoke detectors
 - 12) Supervisory devices

- 13) Elevator location
- 14) Elevator recall system location
- h. Location of fire alarm primary power connections
- i. Location of monitor/control interfaces to other systems
- j. Riser locations
- k. Methods for compliance with NFPA 72 24.3.13 for survivability (emergency voice systems) as required in NFPA 72 12.4 where applicable.
- l. Ceiling height and ceiling construction details
- m. Fire alarm system riser diagram
 - 1) General arrangement of the system, in building cross-section
 - 2) Number of risers
 - 3) Type and number of circuits in each riser
 - 4) Type and number of fire alarm components/devices on each circuit, on each floor or level
- 11. Control unit wiring diagrams shall be provided for all control equipment, power supplies, battery chargers, and annunciators and shall include the following:
 - a. Identification of control equipment depicted
 - b. Location(s)
 - c. All field wiring terminals and terminal identification
 - d. All indicators and manual controls, including the full text of all labels
 - e. All field connections to supervising station signaling equipment, releasing equipment, and fire safety control.
 - f. Typical Wiring Diagram shall be provided for all initiating devices, notification appliances, remote light emitting diodes (LEDs), remote test stations, and end-of-line and power supervisory devices.
- 12. Complete system bill of material of all hardware components.
- 13. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
- 14. Submittal sheets sequentially numbered with the format: sheet number of number total. For example: 1 of 3.
- 15. Complete set of manufacturer's operating instructions, circuit diagrams and the information necessary for proper installation, operation and maintenance.
- 16. Manufacturers catalog cut sheets shall be provide for each piece of equipment with the appropriate model or part number highlighted in cases where multiple model numbers or part numbers are shown.
- 17. Fire detection and alarm system's panel configuration complete with peripheral devices, batteries, power supplies, and interconnection diagrams.
- 18. Submit sound and visual level to confirm that number and location of signaling devices will provide required sound and visual levels throughout the building.
- 19. Sample of proposed graphic/text annunciation.

1.8 OPERATION AND MAINTENANCE MANUALS

- A. Submit complete sets of operation and maintenance manuals. Manual, less as-builts, and sign-off sheets, shall be provided upon completion of the work. Approval of the manual will be required prior to substantial completion.
- B. The Operation and Maintenance Manual shall consist of the following:
 - 1. The manual shall include the names, addresses and telephone numbers of each Contractor installing products, and of the nearest service representative for each product. The manual shall have a Table of Contents and tab sheets. Update manuals to include modifications made during installation, checkout and acceptance. The manual shall include the sections described in the following paragraphs.
 - 2. The Functional Design Section shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Hardware and software functions, interfaces, and requirements shall be provided for system operating modes.
 - 3. The Hardware Section shall describe equipment provided, including general description and specifications, installation and checkout procedure, electrical

schematics and layout drawings. Alignment and calibration procedures, manufacturer's repair parts list indicating source of supply, interface definition, signal identification and wiring diagrams. Also, include a complete parts list of all components as well as a list of recommended spare parts. The spare parts list shall include, for each item, the manufacturer's name, the model of the part, and serial number, if appropriate, and a physical and electrical description of the part.

4. The Software Section shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software module, to instruct the user on programming or reprogramming any portion of the system and other information necessary to enable proper system usage.
5. The Operation Section shall provide instructions for operation of the system, including system start-up procedures, use of system and applications software, alarm presentation (where applicable), failure and recovery procedures, preventive maintenance schedule, parameter schedules and sequence definition, and system access requirements.
6. The Maintenance Section shall provide descriptions of maintenance for equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
7. The Shop Drawings section shall include copies of all approved shop drawings and submittal materials updated to "AS BUILT".

1.9 AS-BUILT DRAWINGS

- A. Prepare and submit detailed "As-Built" drawings. The drawings shall include certified test of the system, testing and acceptance sign-off sheets, and other items specified elsewhere to be performed after initial submission of operation and maintenance manuals, complete wiring diagrams showing connections between all devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as built location of all devices and equipment. The drawings shall show the system as installed, including all deviations from both the project drawings and the approved shop drawings. The drawings shall be prepared on uniform sized sheets, the same size as the project drawings. The plan drawings shall be 11x17 inch and inserted in the specified Operations and Maintenance Manuals. Provide electronic copies in PDF and Autocad.dwg format.

1.10 OPERATIONAL INSTRUCTIONS

- A. Provide a typeset printed or a laser jet printed instruction card mounted behind a lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the Fire Alarm Control Panel (FACP). The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, and trouble. The instructions shall be approved by the Architect/Engineer before being posted.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers acceptable contingent upon Products' compliance with the specifications:
 1. Notifier – Notifier Engineered Systems Distributor
 2. Edwards EST3/EST3X - Local Strategic Partner
 3. Farenhyt – Authorized Farenhyt Distributor / Installer
 4. Cerberus PRO – Authorized and Certified Solutions Partner
 5. Siemens Building Technologies, Inc. XLS-V – Authorized and Certified Solution Partner
 6. Simplex Grinnell, Local Simplex District Office Distributor
 7. Gamewell – Authorized Gamewell Systems Distributor

2.2 SYSTEM DESCRIPTION

- A. System shall be a completely multiplexed addressable fire detection and alarm system, tested and left in first class operating condition. Voice evacuation systems where required or specified, shall have voice alarm notification wherever audible notification is required.
- B. The system shall provide communication with initiating and control devices individually. All of these devices shall be individually annunciated at the fire alarm control panel. Annunciation shall include the following conditions for each point:
 - 1. Alarm
 - 2. Trouble.
 - 3. Open
 - 4. Short
 - 5. Device missing/failed.
- C. System circuits shall be wired as follows: Initiating device circuit (IDCs) shall be Style B, indicating appliance circuit (IACs) shall be Style Y, and signal line circuit (SLCs) shall be Style 4 as describe in NFPA 72.
- D. The system shall contain independently supervised initiating device circuits. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit. All addressable loops shall have loop isolation protection devices to maintain partial fire alarm system integrity should a fault occur. A loop isolation device shall not exceed a maximum of 20 devices.
- E. There shall be supervisory service initiation device circuits for connection of all sprinkler water flow switches and valves. Device activation shall cause a general alarm at the fire alarm control panel. Each flow and tamper switch shall have an individual address.
- F. There shall be independently supervised and independently fused indicating appliance circuits for all alarm signaling devices. Disarrangement conditions of any circuit shall not affect the operation of other circuits.
- G. Auxiliary manual controls shall be supervised so that an "off normal" position of any switch shall cause an "off normal" system trouble.
- H. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the fire alarm control panel. A green "power on" LED shall be displayed continuously while incoming power is present at the building fire alarm control panel.
- I. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the building fire alarm control panel.
- J. The system modules shall be electrically supervised for module placement. Should a module become disconnected, the system trouble indicator shall illuminate and the audible trouble signal shall sound.
- K. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.
- L. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal or supervisory mode for a period of 24 hours with 20 minutes of alarm operation at the end of this period as a minimum. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. If batteries are fully discharged, the charger shall recharge them back to full charge in four hours.
- M. All external circuits requiring system operating power shall be 24 VDC and shall be individually fused at the respective fire alarm control panel.

- N. All addressable devices shall have the capability of being disabled or enabled individually from the fire alarm control panel.
- O. A maximum of 75 percent capacity of addressable devices shall be multi-dropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices within the capability of the designed system are unacceptable. Expansion of the designed system shall be accomplished by factory reprogramming.
- P. The communication format to the addressable devices shall be a completely digital poll/response protocol to allow t-tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.
- Q. Each addressable device must be uniquely identified by an address code. The system must verify that proper type device is in place and matches the desired software configuration. All remote or external panels shall have an individual address for monitoring.
- R. Wiring type, distances, survivability, and wiring configuration types shall be approved by the equipment manufacturer. The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Style Y circuit. Plenum rated fire alarm cable shall have an outer jacket insulation color of red. Minimum wire size shall be #18 AWG.
- S. Each panel extender shall have an individual address.

2.3 FIRE ALARM CONTROL PANEL (FACP)

- A. The FACP shall be capable of communicating with the types of addressable devices specified below. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions. Panel shall support a minimum of 500 addressable points.
- B. The fire alarm control panel (FACP) shall be fully enclosed in a lockable steel enclosure as specified herein. All operations required for testing or for normal care and maintenance of the system shall be performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, the unit enclosures shall match exactly. The system shall operate at 24 VDC.
- C. Panel shall be large enough to accommodate all components and also to allow ample gutter space for interconnection of all panels as well as all field wiring. Each enclosure and each component shall be identified by an engraved red laminated phenolic resin nameplate. Lettering on the nameplate shall not be less than 1" high. Individual components and modules within the cabinets shall be identified by engraved laminated phenolic resin nameplates.
- D. A local audible device shall sound during alarm, trouble, or supervisory conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This audible device shall also sound during each key press to provide an audible feedback to ensure that the key has been pressed properly.
- E. The following primary controls shall be visible through a front access panel:
 1. Minimum 3-lines, minimum 40 alphanumeric characters per line display.
 2. Individual red system alarm LED.
 3. Individual yellow supervisory service LED.
 4. Individual yellow trouble LED.
 5. Green "power on" LED.
 6. Alarm acknowledge key.
 7. Trouble acknowledge key.
 8. Alarm silence key.
 9. System reset key.

- F. Under normal condition, the front panel shall display a “SYSTEM IS NORMAL” message and the current time and date.
- G. Should an abnormal condition be detected, the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The panel audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
- H. The alphanumeric display shall provide the following information relative to the abnormal condition of a point in the system.
 - 1. 40-character custom location label.
 - 2. Type of device (i.e. smoke, pull station, water flow).
 - 3. Point status (i.e. alarm, trouble).
 - 4. Addressed device physical location to correspond to the actual graphic room numbers. Where devices are located in hallways, corridors, or large spaces, the location shall include the hallway, corridor, or large space and in addition reference to the nearest room or other physical object recognizable by the Owner. Example (smoke detector, alarm, Corr 123 by Rm 789), exact format and abbreviations as directed by Owner to fit the panel display format.
- I. Alarm conditions shall be displayed on the alphanumeric display. The top line of 40 characters shall be the point label and the second line shall be the device type identifier. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel. The alphanumeric display shall show the new alarm information.
- J. Each independently supervised circuit shall include a discrete readout to indicate disarrangement conditions per circuit.
- K. Acknowledgment for each abnormal condition shall be provided. Acknowledge keys shall not be pass code protected. Acknowledge keys shall be protected by the locked enclosure only. After all points have been acknowledged, the LEDs shall glow steady and the audible device be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed, along with a prompt to review each list chronologically. The end of the list shall be indicated by the message, “END of LIST”.
- L. Pressing the appropriate acknowledge button shall display the first unacknowledged condition in the appropriate list (either alarm, supervisory or trouble), and shall require another acknowledge button for each subsequent alarm condition. Press to acknowledge shall only silence the displayed point.
- M. Alarm silencing:
 - 1. Should the “Alarm Silence” button be pressed, all audible alarm signals shall cease operation.
 - 2. Visual signals shall not be extinguished during alarm silence inhibit mode.
- N. System reset:
 - 1. The “System Reset” button shall be used to return the system to its normal state after an alarm condition has been remedied. The alphanumeric display or reset LED shall step the user through the reset process with simple English Language messages.
 - 2. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. The audible device and the alarm LED shall be on.
 - 3. Should the alarm silence inhibit function be active, the System Reset and alarm silence key shall be ignored.
- O. Additional function keys, or their equivalent, shall be provided to access status data and control the function for the following points:
 - 1. HVAC - Bypass

2. Indicating appliance circuits bypass
 3. Auxiliary relays points bypass
 4. All other input/output points.
- P. The following status data or their equivalent shall be available:
1. Primary state of point.
 2. Device, PID and card type information.
 3. Current priority of outputs.
 4. Disable/enable status.
 5. Verification tallies of initiating devices.
 6. Automatic/manual control status of output points.
 7. Acknowledge status.
 8. Relay status.
- Q. LED supervision: Where provided, all slave module LEDs shall be supervised for burnout or disarrangement. Should a problem occur the alphanumeric display shall display the module and LED location numbers to facilitate location of that LED.
- R. System trouble reminder: should a trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at pre-programmed time intervals to act as a reminder that the fire alarm system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable.
- S. The fire alarm control panel features shall include, but not be limited to:
1. Setting of time and date.
 2. LED testing.
 3. Alarm, trouble, and abnormal condition listing.
 4. Enabling and disabling of each monitor point separately.
 5. Activation and deactivation of each control point separately.
 6. Changing operator access levels.
 7. Walk test enable.
 8. Running diagnostic function.
 9. Displaying software revision level.
 10. Displaying historical logs.
 11. Displaying card status.
 12. Point listing.
 13. For maintenance purposes, the following lists, or their equivalent, shall be available from the system program and/or the point lists menu:
 - a. All points list by address.
 - b. Monitor point list.
 - c. Signal list.
 - d. Auxiliary control list.
 - e. Feedback point list.
 - f. LED/switch status list.
 14. Fire Drill:
 - a. Fire drill activation switch shall activate all audio/visual devices only. Fire drill shall not enter into the alarm sequence of operation, shall not close smoke or fire/smoke dampers, shall not deactivate any HVAC systems, kitchen hoods, etc.
 - b. Activation of any trouble or alarm condition shall supercede the evacuation drill.
 - c. Fire drill shall be canceled by the system reset key, alarm silence, or drill key.
 15. Scrolling through menu options or lists shall be accomplished in a self-directing manner. These controls shall be located behind an access door.
 16. The alphanumeric display shall have an alpha numeric, back-lighted LCD, LED, or gas plasma display. The display shall support numeric and both upper and lower case letters. Lower case letters shall be used for soft key titles and prompting the user. Upper case letters shall be used for system status information. A cursor shall be

- visible when entering information.
17. The system shall be capable of being tested by one person. The actuation of the “enable walk test” program at the fire alarm control panel shall activate the “Walk Test” mode of the system, which shall cause the following to occur:
 - a. The remote monitoring circuit connection shall be bypassed.
 - b. Control relay functions shall be bypassed.
 - c. The control panels shall show a trouble condition.
 - d. The panel shall be capable of selecting either: the alarm activation of any initiation device causing the audible signals to activate for two seconds or the alarm activation of any initiation devices causing the audible signals to code a number of pulses to match the zone number.
 - e. The panel shall automatically reset itself after signaling is complete.
 - f. Any momentary opening of an initiating or indicating appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating a trouble condition.
 - g. The control panel shall be capable of supporting up to 8 separate testing groups whereby one group of points may be in a testing mode and the other (non-testing) groups may be active and operate as programmed per normal system operation. After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.
 - h. Should the walk test feature be on for an inappropriate amount of time, it shall revert to the normal mode automatically.
 18. Provide three (3) access levels with level 3 being the highest level. Level 1 action shall not require a pass code. Pass codes shall consist of up to ten (10) digits. Changes to pass codes shall only be made by Level 3 authorized personnel.
 - a. When entering a pass code, the digits entered shall not be displayed. All key presses shall be acknowledged by a local audible sound and/or visual “*” in the 80 character display.
 - b. When a correct pass code is entered, the new access level shall be in effect until the operator manually logs out or the keypad has been inactive for ten (10) minutes.
 - c. Should an invalid code be input, access shall be denied.
 - d. Access to a level shall only allow the operator to perform all actions within that level plus all actions of lower levels, not higher levels.
 - e. The following keys/switches, or their equivalent shall have access levels associated with them:
 - Set time/date.
 - Manual control
 - Disable/enable
 - Clear historical alarm log
 - Clear historical trouble log
 - Walk test
 - Change alarm verification
 - f. The following keys/switches shall not be pass code protected and shall be protected by the lockable enclosure:
 - Alarm Silence
 - System Reset
 - Acknowledge
 19. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of being reprogrammed to accommodate system expansion and facilities changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.
 20. Resident software shall allow for full configuration of initiating circuits so that additional hardware shall not be necessary to accommodate changes in, for instance, sensing of normally open contact devices to sensing of normally closed contact devices, or from sensing of normally open contact devices to sensing a combination

- of current limited and non-current limited devices on the same circuit and being able to differentiate between the two, or changing from a non-verification circuit to a verification circuit or vice-versa.
21. Resident software shall also allow for configuration of indicating appliance and control circuits so that additional hardware shall not be necessary to accommodate change in, for instance changing a non-coded indicating appliance circuit to a coded circuit.
 22. The main fire alarm panel shall have the resident ability to store a minimum of 600 system events in chronological order of occurrence. Event history shall include all system alarms, troubles, operator actions, unverified alarms, circuit/point alterations, and component failures. Events shall be time and date stamped. Events shall be stored in non-volatile buffer memory. Access to history buffer shall be secured via 5-digit password security code. The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history. Loss of primary or secondary power shall not erase the events stored in the memory. Each recorded event shall include the time and date of that event's occurrence.
 - a. The following Historical Alarm log events shall be stored:
 - Alarms
 - Alarm acknowledgment
 - Alarm silence
 - System reset
 - Alarm historical log cleared
 - b. The following historical trouble log events shall be stored:
 - Trouble conditions
 - Supervisory alarms
 - Trouble acknowledgment
 - Supervisory acknowledgment
 - Alarm verification tallies
 - Walk tests results
 - Trouble historical log cleared
 23. Alarm verification shall be by device, whereby only verification from the same device will confirm the first activation and cause the alarm sequence to occur.
 24. The control panel shall have the capability to display the number of times (tally) a device has gone into a verification mode. Should this verification tally reach a pre-programmed number, a trouble condition shall occur.
 25. The control panel shall have a dedicated supervisory service LED and a dedicated supervisory service acknowledge key. Pressing the supervisory service acknowledge key shall silence the supervisory audible signal while maintaining the supervisory service LED "ON" indicating the off-normal condition.
 26. Activation of an auxiliary bypass key shall override the selected automatic functions.
 27. The system shall have keys that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time of each occurrence.
 29. Panel shall be sized to accommodate all required equipment. Panel shall be equipped with locks and transparent door, providing freedom from tampering yet allowing full view of the various displays and controls.
- T. The fire alarm control panel shall have a 25% spare initiating point and battery capacity for future use.
- U. The power supply shall provide all control panel and peripheral power needs with filtered power as well as unregulated 24VDC power for external audio-visual devices. The audio-visual power shall be increased as needed by adding additional modular expansion power supplies. All power supplies shall be designed to meet UL and NFPA requirements for POWER-LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits. Design the system power supplies and power trunk wiring for all annunciation devices required, and to add a minimum of five (5) 110cd visual devices in the future. Individual design loading shall not exceed 70% of power supply and system wiring capacity.
1. Input power shall be 120VAC 60Hz. The power supply shall provide internal

- supervised batteries and automatic charger. The power supply shall provide positive and negative ground fault supervision, battery/charger fail condition, AC power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required.
2. Surge protection shall be integral to the control panels.
 3. Each power supply shall be monitored and have an individual address.
- V. Digital Fire Alarm Communicator:
1. Two line primary and secondary telephone line connections
 2. Automatically seizes telephone line.
 3. Automatic verification between panel and receiving station.
 4. Transmits common trouble and supervisory conditions.
 5. Dialer status LED.
 6. Multiple communication formats including Ademco Contact ID.
 7. Dual tone multi-frequency (DTMF) or Pulse modes.
 8. Programming password protected.
 9. UL approved.
- W. IP Internet and Digital Cellular Communicator:
1. UL 864 listed
 2. Supervise IP Ethernet connection every 90-seconds or less
 3. Upload/Download capable
 4. Transmit all signals and information from the DTMF communicator
- X. Detector sensitivity shall be programmable from the control panel from the following sensitivities: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 and 3.7% obstruction. Detectors shall be able to be programmed to alert a trouble signal at a lower obstruction and shall report an alarm if the smoke density increases to a predetermined set point. Control Panel and Detectors shall be capable of "Day-Night" automatic sensitivity adjustments.
- Y. Control Switches:
1. Acknowledge/step Switch
 2. Signal Silence Switch
 3. System Reset Switch
 4. System Test Switch
 5. Lamp Test
- Z. Automatic Detector Test: The system shall include a special automatic detector test feature, which permits reading and adjustment of the sensitivity of all intelligent detectors from the main control panel. An automatic detector test shall occur automatically fourteen times each twenty-four hour period or be initiated manually from the FACP as desired. In addition, the automatic test feature shall also permit the functional testing of any "intelligent" detector or addressable interface device individually from the main control panel. Automatic detector test sequencing shall be terminated upon receipt of an alarm condition. Detector test shall report all unprogrammed devices installed and report all programmed devices not installed.
- AA. Emergency voice alarm communication system:
1. The emergency voice and tone communication system shall be a pre-built system and shall only require two wires from a polarity reversal circuit or a dry contact for activation. It shall supervise the NO dry contact (if used) and provide a form C trouble relay activation in the event of a system fault. The Voice Communication System shall incorporate minimum 50 watts true RMS amplifiers for both tone and speech amplification. The system shall have a load capacity of up to 100 watts. Optionally, the Voice Communication System shall be capable of providing 50 watts of audio with full backup. The Voice Communication System shall be capable of operating as a stand-alone system or follow the activation of the fire alarm/suppression system. The Voice Communication System shall include a regulated power supply and shall be capable of charging and housing its own batteries. There shall be no need to calculate the load requirements or draw any energy from the fire alarm/suppression

- system. The Voice Communication System shall come with one speaker supervisory zone as a standard and shall be capable of supervising any combination of up to 11 speaker and/or strobe monitoring modules.
2. A full set of control switches including an all call, tone interrupt, trouble silence and reset shall be available at the Voice Communications System. The Voice Communications System control panel shall also have a green POWER ON LED, a red ALARM LED, a yellow BROWN OUT LED and a yellow SYSTEM TROUBLE LED.
3. The Voice Communication System shall be able to detect a short on any speaker or strobe zone during the normal and alarm mode. The shorted zone shall be isolated from the system and a dedicated LED on the supervised zone shall indicate the short circuit condition. The system shall produce an audible and visual signal indicating that a trouble condition has occurred. Similarly an open circuit shall create a trouble condition and corresponding LED annunciation at the affected zone and at the main control module. Zones that are not shorted or opened shall remain operational.
4. The Voice Communications System shall be able to detect a brownout condition on the AC supply. In the brownout condition the Voice Communication System shall activate a dedicated LED and an audible trouble signal. Ground faults shall activate the system trouble LED and the audible trouble signal, as well as specific LEDs indicating negative and positive ground faults.
5. The Voice Communication System shall be field configurable for 25 or 70.7 volt RMS audio output via program jumpers.
6. The Voice Communication System shall have a digital message player / recorder. The digital message player / recorder shall be capable of storing alert and evacuation tones as well as an emergency voice message. It shall be possible to modify the digital message and tones in the field using a built-in acoustic microphone or headphone jack connected to an audio device. There shall be no need for the burning of eeproms in order to program the digital message player / recorder. The digital message player / recorder shall be supervised by the Voice Communication System. The Voice Communications System shall provide a backup evacuation tone in the event of a digital message player / recorder failure.
7. An alarm condition shall cause an audible signal and a red LED to activate. A Voice Communication System with a digital message player / recorder shall produce an ALERT tone followed by an emergency voice message, and in turn followed by an ALARM tone. The number of tone repetitions shall be configurable by the setting of DIP switches on the digital message player / recorder.
8. The sheet metal enclosure shall include a hinged deadfront allowing easy access to all the Voice Communication System components for the purposes of wiring, setting the system configuration and servicing. A door with a key lock shall be part of the Voice Communication System enclosure.

2.4 FIELD DEVICES

- A. All devices shall be supervised for trouble conditions. The fire alarm control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Should a device fail, it shall not hinder the operation of other system devices.
- B. Visual Signals:
 1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA and UL 1638 requirements, and 15, 30, or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Provide white with red letters.
- C. Combination Alarm Signal and High Intensity Visual Signals:
 1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized

- flash. Each unit shall provide a Code 3 Temporal tone. The horn shall be capable of an output of 95dB at 10', and intensity adjusted accordingly for the area of coverage. Electronic Mini-Sounder or horn set on low setting shall be provided in interior rooms 900 square feet or less. Mini-sounder shall not be used in any corridors, mechanical electrical rooms and similar large spaces and areas of high ambient noise level. Provide white with red letters.
2. The audible emergency alarms shall produce a sound that exceeds the prevailing sound level in the room or space by at least 15 dba or shall exceed any maximum sound level with a duration of 60 seconds by 5 dba, whichever is louder with or without protective cover. Sound levels for alarm signals shall not exceed 110 dba at the minimum hearing distance from the audible appliance.
- D. Exterior Audible / Visual Signal:
1. Provide semi-flush mounted, molded of high impact red thermoplastic and listed for exterior weatherproof locations.
- E. Combination Voice Signal and High Intensity Visual Signals:
1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash.
 2. The visual signal lens housing shall be white with red lettered FIRE or as approved by Architect. The speaker and visual signal shall be mounted to a common white speaker baffle. The visual signal shall flash at a rate of minimum of 1 Hz and maximum of 3 Hz, and shall use a xenon strobe type lamp or other high intensity long life light source. The lamp intensity shall be a minimum of 75 candela.
 3. The speaker shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. High output speakers, UL minimum 87dB at 10 feet with speaker taps of .33.66/1.25/2.5 watts. Standard output speakers, UL 75-81 dB at 10 feet with speaker taps of .5/1/1.75/2.75 watts. Capacitor for line supervision.
- F. Ceiling mounted recessed mounted speakers shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. UL minimum 78-87 dB at 10 feet with speaker taps of .25, .5/1.0/2.0 watts. Round, white baffle in gypboard or plaster ceilings, provide 2x2 lay-in grid with UL enclosure, tile bridge supports when recessed in lay-in ceiling tiles Capacitor for line supervision.
- G. Surface mounted speakers shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F UL minimum 100 dB at 15 watts at 10 feet. Speaker taps via 7-position selector switch, 25-vol., .48/.94/1.8/7.5/15 watts. Fully enclosed wiring terminals. Capacitor for line supervision. Raco #911 Series Life Safety Appliance back box and adapter, or appliance manufacturer back box.
- H. Manual Pull Station: Addressable pull stations shall contain electronics that communicate the station's status (alarm, normal) to the control panel over two wires which also provide power to the pull station. They shall be manufactured from high impact red Lexan with white lettering. Station shall mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks. Pull stations shall be double action without glass rods. The front of the station shall be hinged to a back plate assembly and shall be opened with a key to reset the station. The key shall be common with the control panels. The addressable manual station shall have address setting programmed electronically and automatically from the fire alarm control panel. Manual stations shall be designed for semi-flush (surface) mounting on standard electrical box. All pull stations units shall have a protective cover, STI Stopper II #STI-1130 surface mounted cover with local alarm horn. Provide STI, Weather Stopper II #STI3150 for locations where dampness, water or dust is present.
- I. Intelligent Photoelectric Smoke Detectors:

1. The detectors shall use the photoelectric principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the ANALOG level of smoke density. The detector shall provide automatic sensitivity "drift" compensation. The detector shall also provide a "maintenance alert" feature whereby the detector shall initiate a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.
 2. The detectors shall provide address-setting means electronically and automatically at the control panel and programmed for alarm verification.
 3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
 4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base. No radioactive material shall be used.
 5. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
- J. Duct photoelectric smoke detectors:
1. Detectors shall be analog addressable type.
 2. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.
 3. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel.
 4. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
 5. Remote alarm/power LED indicator with test switch shall be provided. Unit shall be wall or ceiling mounted in readily visible and accessible area near the location of detector; exact location of unit to be approved by the Architect/Engineer.
 6. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type photoelectric smoke sensors. The detector shall operate in air velocities of 300 FPM to 4,000 FPM. Each detector shall interface directly to the system SLC loop without the requirement of interface zone modules.
 7. The unit shall consist of a clear molded plastic enclosure (or remote mounted LED status indicator shall be provided next to the smoke detector) with integral conduit knockouts to provide visual viewing of detector/sensor for monitoring sensor operation and chamber condition. The duct housing shall be provided with gasket seals to insure proper seating of the housing to the associated ductwork. Each unit's sampling tubes shall extend the width of the duct and be provided with porosity filters to reduce sensor/chamber contamination.
 8. The detectors shall provide alarm and power status indication by LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. Steady illumination of the LED shall indicate that the control panel has detected and verified an alarm condition. An output connection shall also be provided in the base for connecting an external remote alarm LED.
 9. The detectors shall provide address setting means electronically and automatically from the control panel and programmed for alarm verification.
- K. Intelligent Thermal Detectors:
1. The detectors shall use dual electronic thermostats to measure temperature levels in its chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.
 2. The detectors shall provide address-setting means electronically and automatically at the control panel.
 3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.

4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.
 5. Thermal Detectors shall be combination rate-of-rise and fixed-temperature- rated at 135°F for areas where ambient temperatures do not exceed 100°F and shall be 200°F for areas where ambient temperatures exceed 100°F but not 150°F. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft. Detectors shall have a smooth ceiling rating of 2,500 square feet. Detectors shall be located as specified and where required by local code authority.
 6. Provide fixed temperature 190°F detector in kitchen and kiln room in lieu of combination rate-of-rise / fixed-temperature type.
- M. Auxiliary AHU Relays: Air Products model MR-101C relays shall be provided for HVAC and AHU control and interface. Relays shall be heavy-duty type with contacts rated up to 10 amps at 120V AC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with DPDT contacts as well as activated LED indicator.
- N. Voltage sensing relays: Addressable control modules for voltage sensing relay interface shall be FCM-1.
- O. Monitor Module:
1. Addressable monitor modules shall be provided where required to interface to contact alarm devices.
 2. The monitor module shall provide address-setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the monitor module is operational and in regular communication with the control panel, and indicate detection of an alarm condition.
- P. Control Module
1. Control/relay modules shall be provided where required to provide audible alarm interface and/or relay control interface. The control module may be optionally wired as dry contact (form C) relay.
 2. The control module shall provide address-setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the control module is operational and in regular communication with the control panel and indicate when the device is actuated via the fire alarm control panel.
- Q. Auxiliary Interface Points: All auxiliary input points (fire suppression hoods, water flow, fire pump, AHU shut-down points, tamper switches, fire extinguishing systems etc.) shall be connected as required, and addressed as a separate initiating point of annunciation at the fire alarm panel and any remote annunciator as required.
- R. Water flow switches / Valve supervisory switches shall be provided and installed by the fire protection contractor and connected by the fire alarm contractor. Wiring of these field devices to the fire alarm system shall be the responsibility of the fire alarm contractor. It is the responsibility of this contractor to ensure the proper function of the system. Each fire protection zone (flow switch) and (Valve switch) shall be addressed electronically and automatically at the control panel as a separate point of annunciation at the fire alarm panel. Coordinate exact location with fire protection contractor and civil drawings.

2.5 AUXILIARY EQUIPMENT MONITORING

- A. The fire alarm system shall monitor the status of the following equipment when provided as part of this project. A failed status shall activate the trouble alarm.
1. Emergency generator: Run Status
 2. Emergency generator: Trouble Signal
 3. Fire Pump: Run Status
 4. Fire Pump: Trouble Signal

2.6 MAGNETIC DOOR HOLDERS, AUTOMATIC FIRE DOORS / SHUTTERS, AND SECURITY GRILLES AND INTERIOR SPACE CONTROLLED ACCESS EGRESS DOORS WITH AUTOMATIC EMERGENCY EGRESS ELECTRIC LOCK EMERGENCY RELEASE

- A. Magnetic fire door hold open devices, interface for automatic roll down fire doors/shutters, and interface for security grilles and controlled access egress doors with emergency egress shall be provided. Coordinate with Division 8 and Architectural Drawings for exact location.
- B. The operation of any alarm in the fire alarm system shall cause the following:
 - 1. Release of the magnetic fire door holding devices, permitting the fire doors to be closed by the door closer.
 - 2. Permit the automatic roll down fire doors/shutters to close automatically.
 - 3. Permit the security grilles with emergency egress to open automatically.
 - 4. Unlock the electrically controlled access doors in all interior spaces.
- C. The magnetic door holders, automatic roll down fire doors/shutters, security grilles, and interior electrically controlled access doors with emergency egress, shall be associated with two smoke detectors located on the ceiling with one on either side of the fire door/shutter, security grille opening, or interior egress path electrically controlled door. The operation of either of these detectors shall also cause the magnetic holder to release the fire door, the automatic fire door/shutter to close, and the security grille with emergency egress to open.
- D. The operation of smoke detectors associated with a magnetic door holder, automatic roll down fire door, security grille, or electrically controlled access door shall transmit a pre-alarm signal to the fire alarm panel.

2.7 REMOTE ALPHA-NUMERIC DISPLAY ANNUNCIATORS

- A. Remote alpha-numeric annunciator(s) to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator(s) shall be an alphanumeric display similar to the main FACP and operate via the system RS485 or RS232 serial output terminal from the main FACP. The unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote annunciator(s) shall include:
 - 1. Integral time-date clock
 - 2. System reset
 - 3. System silence
 - 4. System acknowledge
 - 5. Display/step switch
 - 6. Integral trouble buzzer
 - 7. LCD contrast adjust
 - 8. Fire Drill Operation
- B. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The following primary controls shall be visible through a front access panel:
 - 1. 80 character alphanumeric display, LCD, LED, or gas plasma
 - 2. Individual red system alarm LED
 - 3. Individual yellow supervisory service LED
 - 4. Individual yellow trouble LED
 - 5. Green "POWER ON" LED
 - 6. Alarm acknowledge key
 - 7. Trouble acknowledge key
 - 8. Alarm silence key
 - 9. System reset key
 - 10. LED test

2.8 REMOTE PAGING UNIT

- A. Remote all-call paging unit or to activate one of the pre-recorded messages over the speaker

circuits.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Installation shall include the delivery, storage, setting in place, fastening to the building structure, interconnection of the system components, alignment, adjustment and all other work, whether or not expressly specified, which is necessary to result in a tested and operational system.
- B. All installation practices shall be in accordance with, but not limited to, the specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements and recommendations of NFPA 72 and the National Electrical Code and any authorities having jurisdiction. Proper protection against corrosion shall be provided on all electrical equipment in accordance with the requirements of the National Electrical Code. The installation shall conform to all manufacturers' recommendations.
- C. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise. Fastenings and support shall be adequate to support their loads with a safety factor of at least three.
- D. All boxes, equipment, etc., shall be plumb and square. The contractor must take such precautions as are necessary to prevent and guard against electrostatic hum, to supply adequate ventilation, and to install the equipment to provide reasonable safety for the operator.
- E. In the installation of equipment and cables, coordinate with Architectural drawings for possible conflicts with millwork, casework, marker boards, furniture, lockers, etc., and notify the architect of any discrepancies. Verify modifications before proceeding with installation.
- F. Mount end-of-line resistor for each box circuit in backbox located at the last manual alarm station or automatic initiating device in a circuit. Mark device accordingly in the field.
- G. Provide three dedicated Cat 6 cables from MDF/IDF to fire alarm panel. Cable shall be installed in 3/4" conduit. Two cables for phone POT lines and one Ethernet data connection.
- H. Upright and/or Wall Post-Indicating Valve: Provide conduit and wiring from fire alarm control panel to post-indicating valve if electronically supervised, coordinate exact location of PIV with fire sprinkler contractor prior to rough-in. Coordinate final location with Civil Drawings and Fire Protection Contractor. Where equipment is located inside a vault, stub required conduit inside vault, turn up and cap.
- I. Contractor shall submit on completion of system verification, a point-by-point check list indicating the date and time of each item inspected and issue a certificate confirming that the inspection has been completed and the system is installed and functioning in accordance with the Specifications prior to date of substantial completion.
- J. Provide remote alphanumeric display annunciators in the administrative area in constantly attended area and additional annunciators where indicated on the drawings.
- K. Provide remote paging units adjacent to each remote alphanumeric display annunciator for voice alarm systems.
- L. Alarm devices shall be ceiling mounted unless indicated specifically otherwise. Alarm devices in Mechanical, Electrical, Communications, IDF / MDF Rooms and Central Plant shall be wall mounted and coordinated with other equipment, piping and ductwork.
- M. Provide combination speaker strobes. Provide strobe only alarms when additional speaker

placement will compromise voice intelligibility. Provide horn/strobes in coolers and freezers.

- N. Detectors shall be installed per NFPA 90A and be listed with the fire alarm control panel.
- O. Auxiliary Equipment Monitoring Wiring and connection to equipment shall be the responsibility of the fire alarm contractor.
- P. Power for magnetic door holders shall be wired through fire alarm relay.
- Q. Smoke detectors shall be mounted to a 4-inch octagon box with hanger bar or with box secured to building structure.
- R. Provide power via 120-volt, 20-Amp dedicated circuits with lock-on provisions at the respective circuit breaker for the main fire alarm control panel, each panel extender and each remote power supply at no additional cost to the Owner. The complete fire alarm system shall be powered under emergency power when emergency life safety power is available at the project site. When emergency life safety power is not available at the project site, power shall originate from the nearest available 120-volt panel. Label 120V circuit origination (i.e.: "120-Volt Circuit ELA-3")
- V. Provide duct smoke detectors in all air handling units with air volumes of 2,000 cfm or larger.
- W. Provide duct smoke detectors on outside air units only as required by local Code and / or A.H.J.
- Y. Provide manual pull stations at each exterior exit and at each exit from all floors. Provide one manual pull station at the central reception area as directed by Owner.
- Z. Provide weatherproof exterior audio/visual alarm devices mounted on the building at the exact location as directed by Architect:
 - 1. Main entry.
 - 2. Courtyards and outdoor assembly areas adjacent to the building.
 - 3. Mechanical yards adjacent to the building.
 - 4. Covered playgrounds or covered assembly areas adjacent to the building.
 - 5. Additional locations where indicated on drawings.
- AA. Provide audio and visual alarm devices in all areas normally occupied by students or minors and all common use areas.

3.2 CABLE AND BOXES INSTALLATION

- A. All fire alarm wiring to be red. All fire alarm circuits shall be identified at each termination and at each 25 feet between terminations. Minimum 18 AWG wire size for data communications, minimum 14 AWG wire size for alarm circuits.
- B. All circuits shall be protected to avoid interruption of service due to short-circuiting or other conditions, which might adversely affect the connected devices. Each individual signaling circuit shall be classified as a circuit pair.
- C. All cabling in racks, cabinets and junction boxes shall be neatly strapped, dressed and adequately supported. Cable installation shall conform to good engineering practices and to the standards of the National Electrical Code.
- D. Cables shall be terminated with the proper connector required for the associated operation of the equipment to which it is connected. Screw terminal blocks shall be furnished for all cables, which interface with racks, cabinets, consoles or equipment modules.
- E. All cables within a rack, console or junction box shall be grouped according to the signals being carried to reduce signal contamination.

- F. Where shielded conductors enter a panel or enclosure, and where power wiring exists, provision shall be made to provide physical isolation of signal and power conductors.
- G. Supply and install all fittings and accessories whether or not they are specified, required for proper, safe and reliable operation of the system.
- H. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit fill shall not exceed 40%.
- I. Minimum conduit size shall be 3/4" EMT with insulated bushings. Install conduit per engineered shop drawings. All conduit terminations in all boxes shall have insulated bushings.
- J. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed to view and or subject to damage.
- K. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.
- L. All junction boxes containing fire alarm wiring are to be painted red and labeled.
- M. All plenum wiring is to be installed parallel and perpendicular to the building structure. Cable shall be bundled with plenum rated cable zip ties on a maximum of 2'-6". Install cable in D-ring hangers, secured to the structure at a maximum of 5' on center. Cable shall not lie on ceiling grid or ceiling tiles, light fixtures, piping, ductwork, or foreign equipment.
- N. The system ground is to be connected to the local ground bus. Under no conditions shall the AC neutral either in a power panel or in receptacle outlets be used for a reference ground.
- O. All wiring shall be in accordance with NFPA 72, the National Electrical Code, and Local Codes. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- P. All wire shall be UL Listed FPL for limited energy (300V) and fire alarm applications and shall be installed in conduit. Limited energy FPLP or MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 and approved by the local authority having jurisdiction.
- Q. No other wiring shall be run in the same conduit as fire alarm wiring.

3.3 FINISHES

- A. Main Fire Alarm Panel color shall be approved by Owner / Architect.

3.4 ALARM SYSTEM SEQUENCE OF OPERATION

- A. General:
 - 1. All fire alarm circuits shall be electrically supervised.
 - 2. Automatic response functions shall be accomplished by the first device initiated. Alarm functions resulting from initiation by the first device shall not be altered by subsequent alarms. An alarm signal shall be the highest priority. A pre-alarm signal shall have second priority and supervisory or trouble signals shall have third and fourth level priority. Signals of a higher level priority shall take precedence over signals of lower priority even though the lower priority condition occurred first.
- B. Fire alarm operating sequences shall be as follows:

1. Activation of any automatic detector, manual station, or sprinkler flow switch shall cause the location of alarm to be identified in an audible and visual manner at the building fire alarm control panel (FACP), and shall initiate the following events:
 - a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledging the alarm condition shall silence the audible trouble device and revert the flashing common alarm LED to a steady state.
 - b. The alphanumeric display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location, and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.
 - c. Any remote or local annunciator LED's associated with the alarm point shall be illuminated as herein specified.
 - d. The remote signaling connection shall be activated relaying the alarm signal to an approved central station (central station connection and service provided by Owner). Point ID and descriptor must be sent and received.
 - e. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated.
 - f. Activate all audible/visual alarm devices. Where prerecorded voice announcement is required or specified, the prerecorded announcement shall be preceded with attention tone(s), followed by the approved prerecorded announcement and continue in a cycle until the system is reset. Manual voice announcement shall interrupt the prerecorded cycle and the prerecorded cycle shall resume automatically after three minutes.
 - g. De-activate all HVAC systems.
 - h. De-energize the kitchen hood supply/exhaust fans as required by local authority having jurisdiction.
 - i. Close all related smoke dampers.
 - j. Close all related smoke/fire dampers.
 - k. Release all magnetic door hold open devices.
 - l. Release the electric strike, unlocking, but not unlatching, locked doors controlled by an access control system.
 - m. Release Counter Shutters and hold-open devices on all fire and smoke doors.
 - n. Open all security grilles with emergency egress.
 - o. Activate to close all related fire and smoke doors and shutters.
 - p. Activate signaling connection to the elevator as required by the local authority having jurisdiction.
 - q. Signal the building automation system and security system, and Owner's security/police personnel as directed by Owner/Architect. The audible alarms shall be inhibited from being silenced for a period of 3 minutes after commencing operation unless alarm is acknowledged and appropriate action has been taken.
 - r. Activate automatic recall operation of elevators as required by local authority having jurisdiction.
2. Activation of duct mounted smoke detector on the HVAC equipment, or a smoke detector mounted in the return/supply air stream of any fan shall shut down all units as required by NFPA. The activation of one of these detectors shall send an alarm signal to the control panel and also initiate the Alarm Sequence of Operation.
3. Activation of a control valve supervisory switch shall initiate the following events:
 - a. The activation of any sprinkler valve supervisory (tamper) switch shall activate the system supervisory service audible signal and illuminate the LED at the building fire alarm control panel (FACP). Differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring shall be provided.
 - b. Activation of a sprinkler system control valve supervisory switch shall not prevent the events listed under Article 3.4.
 - c. Restoring the valve to the normal position shall cause the supervisory service audible signal to pulse, indicating the restoration to normal position.

The supervisory service reset key shall be provided to silence the audible signal.

4. Activation of the smoke detector and heat detector in the elevator machine room and at top of elevator shaft shall cause the elevators' controllers to be tripped by way of the shut trip breaker, and shall also initiate the events listed under Article 3.4.
 5. Any subsequent fire alarm shall reactivate the alarm indicating appliances and activate the respective control sequences described above.
 6. Upon reset of the fire alarm control panel, HVAC units shall be capable of being started, and resume normal operation.
- C. Activation of the manual evacuation (drill) switch shall operate the alarm indicating appliances without causing other control circuits to be activated. However, should true alarm occur, all alarm functions should occur as described.
- D. ALARM VERIFICATION shall be field programmed for each respective detector. Global verification will not be acceptable. The verification sequence is activated after a "check" procedure and the panel will wait a field programmable delay period (0-50 seconds) then proceed to re-sample the detector for continued presence of smoke. If the alarm condition still exists or a non-verified device is actuated during the verification period, the system will then initiate all alarm sequences specified herein. The system shall incorporate the ability to log in memory the number of verification events that have occurred for each selected device.

3.5 EQUIPMENT IDENTIFICATION

- A. Each panel or equipment enclosure shall be provided with a permanently engraved or embossed or silkscreen identification tag. The tag shall include the following information:
1. Name of manufacturer.
 2. Manufacturer's equipment description.
 3. Serial number and model number.
 4. Voltage and current rating.
- B. All addressable devices shall be labeled with point and module number. Provide label maker style label on base of device. Verify exact requirements with Owner.

3.6 SPARE PARTS AND TOOLS

- A. Interchangeable Parts: All spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the site in unopened cartons for storage as directed by the Owner.
- B. Spare Parts: Provide minimum of two, or 5% of building total, whichever is greater unless noted otherwise.
1. Spare shut down modules
 2. Spare detectors of each type in the system
 3. Spare alarm indicating devices of each type in the system
 4. Spare manual pull stations
 5. Spare protective covers of each type in the system.
 6. Spare relays/controls required for connection to smoke and fire/smoke dampers
 7. Devices listed above are to be installed as directed by Architect/Engineer or local code authorities at no additional cost to the Owner. Unused spare parts are to be parts for Owner's cabinet.
- C. Provide two copies of the final software programmed into the fire alarm system.
- D. Parts list: Furnish a list, in duplicate, of all other parts and accessories the manufacturer of the system recommends to be stocked for maintenance.

3.7 KEYS

- A. Keys and locks for all equipment shall be identical. Provide not less than six keys of each type required. Identify keys by an appropriate number stamped on each key or on a metal tag attached thereto. Provide a key numbering chart in each operation and maintenance manual furnished.

3.8 SMOKE DAMPERS AND FIRE/SMOKE DAMPERS

- A. Smoke dampers and combination fire/smoke dampers shall be controlled by an automatic alarm initiating device. Smoke dampers installed to isolate the air handling system shall be arranged to close automatically when the system is in alarm.
- B. Coordinate motor operator voltage with supplier.
- C. Open all dampers prior to starting air handling equipment.
- D. Provide 120V power from nearest general purpose 20A receptacle circuit as required, or as noted otherwise.

3.9 GRAPHIC FLOOR PLANS

- A. Provide two (2) color coded floor plan detailed with project name, actual room names, actual graphic room numbers as directed by the Owner and adequate information to direct people to the fire alarm devices in alarm and to exits with non-fading floor plan media. Do not use architectural plan room names and numbers.
- B. Each plan shall clearly relate the room numbers on the annunciator to the area description on the floor plan. All fire alarm devices located to correspond with the annunciator. Indicate location of all end-of-line resistors.
- C. The floor plan shall be solvent welded in acrylic plastic.
 - 1. Mount in an extruded aluminum frame next to the main fire alarm control panel and annunciator in main office. Minimum size 30x42 inches. Coordinate exact location with Architect / Owner.
 - 2. Provide a minimum 1 inch x 17 inch graphic print of building showing all rooms by graphic room numbers. Print shall show all detectors, major equipment and active detection devices. Print shall be framed in an extruded aluminum frame (24"x36") with clear plastic cover. Graphic shall be prepared in AutoCad version 2011 or newer. Data file (xxx.dwg) of graphic shall be provided as a part of the project.
- D. Install graphic floor plans as directed by Architect/Owner prior to substantial completion. Each area or room designation shall be verified with the fire alarm device during testing.

3.10 OPERATING INSTRUCTIONS

- A. Coordinate with Owner for appropriate off-site monitoring service and communication technology to be used. Provide all necessary programming for interfacing with the Owner's on-site and off-site remote signaling receiving station, including programming of descriptors and addresses at the receiving station.
- B. Provide Fire Alarm System Operating Instructions for the following items including, but not limited to:
 - 1. Alarm Signal
 - a. How to open panel door
 - b. What to read and follow the instruction on display
 - c. How to acknowledge alarm
 - d. How to silence the signals
 - e. How and when to reset the system
 - f. How to return system to normal operation

2. Trouble / Supervisory
 - a. How to open panel door.
 - b. What to read and follow the instruction on display
 - c. How to acknowledge trouble condition
 - d. Appropriate personnel to respond
- C. Provide laminated instructions in extruded aluminum frame. Mount adjacent to the Fire Alarm Control Panel and remote annunciator panel(s) for ready reference.

3.11 ADDITIONAL REQUIREMENTS

- A. The contractor is to ensure all areas of the building are covered with visual and audio alarm devices for occupant notification of a fire alarm, including remote portable or temporary buildings.
- B. Coordinate door hold devices with door and door hardware.
- C. Provide interface with and coordinate shunt-trip circuit breakers and control devices with kitchen hood fire control systems and elevator equipment.
- D. Alarm circuit power supplies and circuiting shall be designed and installed to accept an additional five (5) 110cd visual devices for future expansion. The initial design shall not exceed 70% of the rated power supply and circuit capability.
- E. Provide programming or re-programming of all hot keys as directed by Owner including, but not limited to, fire drill, AHU shutdown bypass, horn/strobe disable, elevator test.

3.12 COMMISSIONING THE SYSTEM

- A. The installing contractor shall be responsible for verifying that each component of the system is fully operational and in conformity with the specifications. He shall also be responsible for insuring that all elements function together as a system in accordance with the specifications.
- B. A state licensed NICET II minimum and factory trained technical representative of the manufacturer shall supervise the final control panel connections and testing of the system. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.
- C. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. Field testing shall include voice intelligibility as required by the latest edition of NFPA 72 Any items found not properly installed or non-functioning shall be replaced or repaired and retested. The final test indicating a fully functional fire alarm system shall be recorded and an electronic Excel and printed copy submitted to the Architect, Engineer and Owner.
- D. The installing contractor shall provide a complete written report in electronic form and printout of the functional test and intelligibility test of the entire system. A copy of the test report shall be provided with the Maintenance and Operation Manuals. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout. This test shall be witnessed and accepted by the Owner prior to testing for the local Fire Marshall.
- E. The installing contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction. The contractor shall be responsible for making any changes, adjustments, or corrections, as may be required by the local authorities. The Contractor shall affix his certification label and installation certificate to the interior of the main fire alarm control panel.
- F. The testing and acceptance shall be performed within 30 days after the fire alarm installation

is completed. The test shall be performed by a minimum of two qualified fire alarm system technicians acceptable to the authority having jurisdiction. The test which is a comprehensive 100 percent inspection and test of all fire alarm system equipment shall include the following:

1. Fire alarm control equipment: a visual and functional test of the fire alarm control and auxiliary control equipment.
 2. A visual inspection shall be conducted to establish that all electrical connections and equipment, as required, are properly installed and operating.
 3. A functional fault simulation test shall be conducted on all relevant field wiring terminations to ensure that wiring is properly supervised as required.
 4. Indicators shall be tested to ensure proper function and operation.
 5. Control panel auxiliary functions shall be functionally tested to verify proper operation.
 6. Control panel supervisory and alarm current readings shall be taken to verify that the control panel has the appropriate power supplies and standby batteries to operate the system as required. A three-minute general alarm stress test, both under AC power and standby power, shall be conducted to further ensure complete operation of the system.
 7. Fire alarm peripheral devices; All fire alarm peripheral devices shall be functionally tested and the location and testing information recorded for each device.
 8. Manual initiating devices:
 - a. Each manual fire alarm station shall be functionally tested for alarm operation.
 - b. Each manual fire alarm station shall be functionally tested for proper wiring supervision.
 9. Automatic initiating devices:
 - a. Each automatic initiating device shall be activated in accordance with manufacturer's instructions to ensure proper operation.
 - b. Each automatic initiating device shall be functionally tested for proper wiring supervision.
 - c. Each automatic initiating device shall be inspected to ensure proper placement and mounting as required by specifications.
 10. Alarm signaling devices:
 - a. Each alarm signaling device shall be tested and decibel reading taken at 10' from the device and recorded to ensure proper operation. Each area's voice alarm signaling devices shall be tested for intelligibility.
 - b. Each alarm signaling device shall be functionally tested for proper wiring supervision.
 - c. Decibel reading shall be taken to ensure that the alarm signal level can be clearly heard in all areas of the facility.
 - d. All visual alarm indicators shall be functionally tested to ensure proper operation and that they are clearly visible.
 11. Elevators: Each elevator shall be tested and automatic recall function verified.
 12. Reporting: Upon completion of the initial verification audit, a report shall be sent to the Architect/Engineer indicating that all fire alarm equipment has been tested and is in 100 percent operation. The report shall also contain the audit testing information as to the location and operational status of each peripheral device. The 100 percent audit shall be performed by a factory-trained representative. The report shall include the voice intelligibility performance in each area and indicate compliance with NFPA and local AHJ requirements.
- G. It is the intent of these specifications and of the Architect/Engineer that a continued program of system maintenance is to be provided by the Owner in compliance with NFPA 72. It is mandatory that the installing Contractor provide such services and make available these services to the Owner upon completion of the project.
- H. Upon completion of installation and full acceptance testing, submit NFPA 72 certificate of compliance that the total fire alarm system, including any subsystems, is fully functional and that the components are UL listed for function intended.

3.13 SUBSTANTIAL COMPLETION

- A. Final acceptance of the FIRE ALARM SYSTEM by the owner, local code authorities and Occupancy Permit has been issued.
- B. All fire alarm system shop drawings, test reports, operating and maintenance manuals, maps and as-built drawings shall be submitted in electronic format to and accepted by the Architect / Owner prior to date of substantial completion.
- C. Acceptance by County or Local Fire Marshall.

3.14 WARRANTY

- A. The fire alarm system, including labor and material, shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of substantial completion. Major components including but not limited to the main fire alarm panel, sub-panels, panel extenders, power supplies and remote annunciators. Any equipment or workmanship shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner within 4-hour notification. Any equipment replaced shall be complete with full factory warranty for that part beginning on the date of installation.
- B. Repair services and replacement parts for the system to be furnished under this Contract shall be available for a period of ten years after the date of final acceptance. Service during the warranty period shall be provided within four hours after notification and all repairs shall be corrected within 24 hours after notification throughout the warranty specified in this section.
- C. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.
- D. The equipment manufacturer shall be represented by a local service organization and the name of such shall be furnished to the Owner, Architect, and Engineer.
- E. Provide a certified fire alarm test of the complete system no earlier than 30 days prior to the end of the warranty period and correct any and all items to bring the system to an approved status at no cost to the Owner. Clean all smoke detectors and replace all defective parts at no cost to the Owner.
- F. Guarantee labor, materials, and equipment provided under this contract against all defects for a period of one year after the date of final acceptance and receipt and approval of "As-Built" drawings and schematics of all equipment.
- G. All manufacturer's warranties which extend past final completion shall be fully transferred to the Owner.

3.15 TRAINING

- A. Provide training course to all fire personnel assigned by Owner's Representative. The training shall include a course syllabus and hands-on participation. Training shall be conducted on a system identical to the one being installed on this project. The system shall be able to perform all system operations and simulate all types or forms of alarm conditions.
- B. Provide a video of the training program to the Owner's Representative to be used for periodic refresher course, training of the local fire department and for training of new employees.
- C. The training course shall include, in addition to the above, a system overview, and a review of the operation and maintenance manual.
- D. The instructor shall be factory trained and shall be thoroughly familiar with all parts of the installation on which instruction is to be given. The instructor shall be trained in operating theory as well as in practical operation and maintenance work.

END OF SECTION

SECTION 0312001 – EARTHWORK FOR BUILDING FOUNDATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes the following within the building footprint:
 1. Site Preparation for building foundations.
 2. Excavation for building foundations.
 3. Backfill for building foundations.
 4. Fill for building foundations.

1.3 DESCRIPTION OF WORK

- A. Extent of work included in this section pertains to earthwork for building foundations.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. The Owner will employ an Independent Testing Laboratory to conduct all inspections and testing of fill materials and compaction of fill and backfill.
 1. The testing lab shall be in compliance with ASTM E 329 "Standard Specification for Agencies Engaged in Construction Inspection and/or Testing" and ASTM D 3740 "Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction".

1.5 JOB CONDITIONS

- A. Site Information: Data in subsurface investigation reports was used for the basis of the design and are available to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor
 1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.
- B. Existing Utilities: Locate existing underground utilities, if any, in the areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
 1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the Utility Owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
 2. Demolish and completely remove from site existing underground utilities indicated to be removed.
 3. Coordinate with utility companies for shutoff of services if lines are active.
- C. Use of Explosives: The use of explosives is not permitted.
- D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction.

1. Operate warning lights as recommended by authorities having jurisdiction.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Backfill and Fill Materials: the area shall be brought to grade using a clean, select, fill material free from debris or organic matter.
- B. Cohesionless soil: Cohesionless soil fill shall be clean sand with less than 10% passing the U.S. No. 200 sieve. Alternatively, a lean, silty or sandy clay (CL – USCS Classification) may be used for fill. The clay fill shall have a Liquid Limit of less than 40 and a Plasticity Index (PI) of less than 20.
- C. Compaction: Fill shall be placed in 10 to 12 inch loose lifts at a minimum compaction criteria of dry density at least equal to 95% of its maximum, as determined by the Standard Proctor compaction test (ASTM D698) shall be used for fill.
 1. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).

PART 3 - EXECUTION

3.1 SITE PREPARATION

- A. Site preparation shall include removal of all existing surficial features such as buildings, pavements, utilities, etc., limited tree removal, stripping of existing surficial soils, some limited cutting and filling in some areas to establish final grades.
- B. Any existing foundations, slabs, and utilities that are encountered during construction, shall be removed from within the proposed building footprint and at least 5 feet beyond the outer edge of foundations.
- C. Establish adequate drainage to prevent ponding of water and ensure immediate runoff of all rainfall. Should areas of ponding water develop, the Contractor shall immediately pump ponding water away from areas of construction.
- D. Demolition: Provisions shall be made to locate any abandoned underground utilities and foundations which could impact new construction. Existing footings and abandoned pipes shall be removed from site. Voids and dips left by these excavated items shall be proof rolled and backfilled with structural fill material. Removal of excavated structures shall also conform to the requirements of the local jurisdiction.
- E. Cleaning and Stripping: Construction areas shall be stripped of vegetation, topsoil and other debris/unsuitable surface material. Select fill soils shall be used to raise grade up in the proposed building area. Proper site drainage shall be maintained during construction so that ponding of surface runoff does not occur and cause construction delays and/or inhibit site access. Once final subgrade elevations have been achieved, the exposed subgrade shall be carefully proof rolled with a 20-ton pneumatic roller or equivalent equipment, such as a fully loaded dump truck, to detect weak zones in the subgrade. Special care shall be exercised when proof rolling areas containing fill soils to observe soft/weak zones within the fill soils. Weak areas detected during proof rolling, as well as zones of fill containing organic matter and/or debris, shall be removed and replaced with structural fill. Proof rolling shall be performed under the direct observation of the Owner's Independent Testing Laboratory or his/her representative and may be waived at the discretion of the Independent Testing Laboratory.

- F. Exposed subgrade shall be densified using a heavy vibratory roller having a maximum static weight of 12,000 lbs. and capable of exerting a minimum impact energy of 20,000 lbs.
- G. Subsequent to proof rolling, and just prior to placement of fill, the exposed subgrade within the construction area shall be evaluated by the Owner's Independent Testing Laboratory for moisture and density. If the moisture and/or density do not meet the criteria described in Fill Compaction Requirements for on-site soils, the subgrade shall be scarified to a minimum depth of 8 inches, moisture adjusted, and compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density.
- H. Site excavation, fill pad compaction, and foundation installation shall be observed by a representative of the Owner's Independent Testing Laboratory.

3.2 EXCAVATION

- A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of the character of materials and observations encountered.

3.3 STABILITY OF EXCAVATIONS

- A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.
- B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.
- D. Provide permanent steel sheet piling or pressure-creosoted timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops a minimum of 2'-6" below final grade and leave permanently in place.

3.4 DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 - 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 - 2. Convey water removed from excavations and rain water to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

3.5 EXCAVATION FOR STRUCTURES

- A. Conform to elevations and dimensions shown within a tolerance of plus 2 inch or minus inches, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete form work, installation of services other construction, and for inspection.
 - 1. In excavating for footings and other subgrade construction, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.
 - 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus, a

sufficient distance to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection. Do not disturb bottom of excavations, intended for bearing surface.

3.6 BACKFILL AND FILL

- A. General: Place select soil material in layers to required subgrade elevations, using materials specified in Part 2 of this Section.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Acceptance by Architect of construction below finish grade.
 - 2. Inspection, testing approval, and recording locations of underground utilities.
 - 3. Removal of concrete formwork.
 - 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures or remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
 - 5. Removal of trash and debris.
 - 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.7 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes.
- C. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation.
- D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density.

3.8 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed as required by Architect.
 - 1. Perform field density tests in accordance with ASTM D 1556 (sand cone method).
 - 2. Confirm suitability of select fill material by Atterberg Limit tests at the rate of at least one test per 500 cubic yards.
- B. Building Slab Subgrade: Perform at least one field density test of subgrade for every 5,000 sq. ft. of building slab.
 - 1. In each compacted fill layer, perform field density test, as indicated above.
 - 2. If in opinion of Architect, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained.

3.9 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.10 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Removal from Owner's Property: Remove trash debris, excess excavated material and waste materials and lawfully dispose of it off the Owner's property. Remove these items from the site, at regular intervals. Do not allow these items to accumulate on-site.

END OF SECTION

EXCAVATION

SECTION 312316

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavating for paving, utilities, and detention pond on the site.

1.2 RELATED SECTIONS

- A. Section 01 73 00 - Execution Requirements
- B. Section 31 23 23 - Fill and Backfill: Fill materials, filling, and compacting.

1.3 PROJECT CONDITIONS

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.
- B. Take extreme caution when excavating on this site as there are extensive root systems for existing trees. No branches or roots should be cut without the guidance of an arborist. Air spading and hand digging will be required in some locations.

PART 2 - PRODUCTS

2.1 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the work are as indicated.

2.2 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Notify utility company to remove and relocate utilities.
- D. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Take extreme caution when excavating on this site as there are extensive root systems for existing trees. No branches or roots should be cut without the guidance of an arborist. Air spading and hand digging will be required in some locations.

2.3 EXCAVATING

- A. Excavate to accommodate new site work.
- B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- C. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- D. Cut utility trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Correct areas that are over-excavated and load-bearing surfaces that are disturbed
- G. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- H. Remove excavated material that is unsuitable for re-use from site.
- I. Remove excess excavated material from site.

2.4 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

2.5 PROTECTION

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION

FILL AND BACKFILL

SECTION 312323

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Filling, backfilling, and compacting for footings, slabs-on-grade, paving, and utilities within the building.
- B. Backfilling and compacting for utilities outside the building to utility main connections.
- C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.2 RELATED SECTIONS

- A. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.

1.3 REFERENCE STANDARDS

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2009.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2007.
- C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- D. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2007.
- E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- F. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2006.
- G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- H. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
- I. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2005.

1.4 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. Samples: 10 lb sample of each type of fill; submit in air-tight containers to testing laboratory.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. General Fill - Mississippi River pump sand.
- B. Sand - Fill Type Mississippi River pump sand.: Natural River or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
- C. Grade in accordance with ASTM D2487 Group Symbol SW.

2.2 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the work are as indicated.
- B. Identify required lines, levels, contours, and datum locations.
- C. Verify structural ability of unsupported walls to support imposed loads by the fill.

3.2 PREPARATION

- A. Scarify subgrade surface to a depth of 6 inches to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.3 FILLING

- A. Fill to elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other work.

- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 8 inches compacted depth.
- G. Correct areas that are over-excavated.
- H. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- I. Compaction Density Unless Otherwise Specified or Indicated:
- J. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.

3.4 TOLERANCES

- A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.
- B. Top Surface of Filling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.5 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Frequency of Tests: 1/250 sf or 1/25 lf. trench.

3.6 CLEANING

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

TRENCHING FOR SITE UTILITIES

SECTION 312333

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Trenching and backfilling of utility trenches
- B. Quality control on site
- C. Cleaning upon project completion

1.2 RELATED SECTIONS

- A. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. Sand - Fill Type Mississippi River pump sand.: Natural River or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

2.2 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Provide materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the work are as indicated.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.
- C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 TRENCHING

- A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Cut trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove excavated material that is unsuitable for re-use from site.
- G. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 23 16.

- H. Remove excess excavated material from site.

3.4 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.5 BACKFILLING

- A. Backfill to elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 8 inches compacted depth.
- G. Slope grade away from buildings a minimum 2 inches in 10 ft, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- H. Correct areas that are over-excavated.
 - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- I. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving and similar construction: 95 percent of maximum dry density.
- J. Reshape and re-compact fills subjected to vehicular traffic.

3.6 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.7 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Frequency of Tests: 1/2500.

3.8 CLEANING

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 316200 – DRIVEN PILES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Furnish all labor, materials, tools, and equipment, and perform all operations necessary for piling work indicated or specified.
- B. This Section includes the furnishing and driving of the following types of piling:
 - 1. Treated Timber Piles.
 - 2. Treated Timber Test Piles.
 - 3. A test pile program is included as part of the Work.

1.3 DAMAGE TO EXISTING PROPERTY

- A. Investigate the existing adjacent buildings, sewers, and utilities. Take proper and necessary precautions to protect those things from damage due to the execution of the Piling work. Should damage occur due to the Contractor's negligence, responsibility and cost for repairing or replacing the work in original condition shall be borne by the Contractor, without additional compensation.

1.4 SUBSURFACE INFORMATION

- A. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that the Contractor will be responsible for all interpretations or conclusions which he draws from the subsurface information. Data are made available in the office of the Architect for the convenience of Contractor.
- B. Additional soil borings and other exploratory operations may be made by Contractor at no cost to Owner.

1.5 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications.
 - 1. Treated/Untreated Timber pile data.
 - 2. Pile installation equipment, including hammer and drill information.
 - 3. Product Data: Submit manufacturer's specifications and instructions for manufactured materials and products/ Include manufacturer's certifications and laboratory test reports.
- B. Reports:
 - 1. Furnish independent testing laboratory reports of tests and inspections as required in this specification.

1.6 QUALITY ASSURANCE

- A. The Owner's independent testing laboratory shall perform the following:
 - 1. Treated Timber Piles: Inspect at source of supply and hammer mark in the butt to indicate conformance with the requirements of these specifications.
 - 2. Logging of pile driving: Log the driving of all piling including reaction piles and record the following:
 - a. Date driven.
 - b. Hammer description.
 - c. Dimensions of piles as measured on jobsite.
 - d. Location of pile.

- e. Depth and size of predrill
 - f. Number of blows per foot for full length of pile. For exploratory piles, use painted foot marks for the entire length of each pile.
 - g. Submit driving records daily, no later than the morning after each completed day of pile driving.
- B. Vibration Study: During the driving of all piles, the laboratory shall monitor and record the vibrations to adjacent and surrounding areas. The laboratory shall employ the services of a vibration specialist engineer who in conjunction with the laboratory shall render complete reports and interpretations of the data obtained, including the possible effects of the measured vibrations on adjacent and surrounding structures. The vibrations shall be measured by means of a portable Seismograph which directly measures particle velocity (rate of ground movement) in three mutually perpendicular directions (longitudinal, transverse, and vertical). Probes shall be located at various locations as directed. A complete report of the vibration study, including seismograms, shall be furnished after the conclusion of the driving of these piles. Peak particle velocities, measured at the surface, shall not exceed 0.25 inches per second. Should this limit be exceeded, pile driving operations shall be paused, and the Engineer of Record shall be contacted in order to coordinate a method to reduce pile driving vibration.
- C. Notification Prior to Start of Pile Driving: The Contractor shall notify the Architect/Engineer and the testing laboratory a minimum of 48 hours prior to start of all pile driving activities.
- D. Rejection of Materials: The Laboratory shall notify the Contractor or his authorized representative, of any materials which are not in full conformance with the Specifications, and the Architect shall be informed of such notification.
- E. Exploratory Piles: The Contractor shall drive five (5) exploratory treated timber piles, having properties and dimensions as specified herein. Locations of the exploratory piles shall be as indicated on the Drawings.
- F. Load Test: The independent testing laboratory shall conduct one (1) static load tests on piles selected by the Engineer of Record. The load test shall have cyclic loads with rebounds and long term loading. The pile shall then be loaded to its ultimate capacity. Laboratory shall furnish an accurately calibrated hydraulic jack and load cell with a capacity of 100 tons. Reaction piles shall be located a minimum distance of 8 feet clear between the outer surfaces of the test pile and reaction piles. Load test shall meet the requirements of the International Building Code. Application of load shall commence no sooner than 14 days after exploratory piles and reaction piles are driven.
- G. Loading Procedure for the 25 ton design load piles shall be as follows:
- H. Begin Load Test no sooner than fourteen (14) days after driving pile to be tested, and reaction piles.

<u>Increment</u>	<u>Load (Tons)</u>	
1	5	
2	10	
3	15	Hold each increment 1 thru 5, 1-hour free of movement.
4	20	
5	25	
6	20	
7	15	Hold each decrement 6 thru 9, 15 minutes.
8	10	
9	5	
10	0	Hold 1-hour free of movement.
11	5	Hold each increment 11 thru 15, 1 hour free of movement.
12	10	
13	15	

14	20	
15	25	
16	30	Hold each increment 16 thru
17	35	20, 1-hour free of movement.
18	40	
19	42.5	
20	45	
21	47.5	Hold each increment 21 thru 29, 1 hour free
22	50	of movement
23	52.5	
24	55	If pile begins to fail before reaching 50 tons,
25	57.5	rebound in 4 equal decrements from
26	60	failure load.
27	65	
27	70	
29	75	
		5 ton increments to failure.
		Hold each increment 1-hour
		free of movement. After failure,
		rebound in 4-equal decrements.

- I. Additional Tests: The Architect reserves the right to require additional tests to those specified or upon materials not herein specified for testing. If such tests are necessary because of apparently defective materials or workmanship, the cost of these additional tests shall be borne by the Contractor.

PART 2 - PRODUCTS

2.1 TREATED TIMBER PILES

- A. Shall meet ASTM Designated D25 (latest revision) round timber piles for quality, clean peeled, Southern Pine with a minimum tip diameter of 7 inches and a minimum butt diameter of 13 inches, three feet from the pile butt.
 1. Treated Timber Test Piles shall meet ASTM Designated D25 (latest revision) round timber piles for quality, clean peeled, Southern Pine with a minimum tip diameter of 7 inches (7½" maximum) and a minimum butt diameter of 13 inches (14" maximum), 3 feet from butt.
- B. Solution For Brush Treatment: Treatment solution containing a percentage of Copper Napthenante conforming to AWWA Specification M4.
- C. Preservative Treatment: Comply with AWWA Standards P5-08, U1-08 and T1-08 with minimum net retention of 0.80 lbs. per cu. ft. of wood and penetration as required for foundation piles. Preservative shall be CCA.
- D. Length: As indicated on the Drawings.
 1. Exploratory Pile Length shall be 4'-2" longer than Contract Piles.

PART 3 - EXECUTION

3.1 HANDLING

- A. Piles shall be carefully handled to prevent damage to timber piles.

3.2 EQUIPMENT

- A. Driving equipment is subject to the Architect's approval. Architect will reject equipment if in his opinion, at any time, the equipment does not perform its intended task adequately.

3.3 PREDRILL

- A. Prior to driving each pile, predrill as indicated on the drawings using a Demon SH-800 wet-rotary type 3-blade bit. Immediately thereafter drive the pile into the drilled hole. Use a minimum amount of water during predrilling operations. The Contractor shall have the capability to predrill to a depth of 50 feet, at no additional cost to the Owner. The Architect may require the Contractor to change the depth and size of predrill. If this is necessary, it shall be done at no additional cost to the Owner.

3.4 HAMMERS

- A. No. 1 Vulcan (15,000 ft. lbs. per blow) for all piles.

3.5 DRIVING PROCEDURE

- A. Driving of Contract Piles shall not start until all site preparation, fill placement and proof rolling operations within the building footprint are complete, in accordance with Section 312001.
- B. Driving shall be done with fixed leads that shall hold the pile firmly in position and in alignment with the hammer. The top of each pile before driving shall be cut at right angles to the longitudinal axis of the pile. The top of the pile shall be protected with a standard steel hood or similar-type device which will prevent damage to the pile during driving.
- C. Drive continuously until proper penetration as determined by the Architect is obtained.

3.6 LOCATION

- A. Piles shall be driven plumb and accurately into positions shown on Drawings: a maximum variation not exceeding 3" for each pile will be accepted as fulfillment of Contract, providing limiting and controlling conditions make it impossible to maintain more accurately the spacing indicated on plans. Maximum tolerance from the vertical shall be 1.5 feet in 100 feet. Should the variations from true center or vertical exceed the above, the piles in each cluster shall be plotted by the Contractor and the center of gravity of said cluster determined. If required, sufficient pile shall then be added at locations determined by the Architect. Contractor shall, at his own cost, drive such additional piling and/or alter pile caps as may be required to compensate for or to rectify the conditions brought about by failure to preserve proper spacing and plumbness, whether this defect is discovered before or after cutting off.

3.7 DEFECTIVE PILES

- A. Immediately remove and replace a pile that is damaged, deflected, broken, or which cannot be driven to proper elevation because of interference by underground obstruction. Replace such pile with an acceptable substitute pile at the location determined by the Architect. In the event that such pile's removal should prove to be impossible, abandon the defective pile; replace with an additional pile(s) driven close to the worthless one as directed by the Architect.

3.8 CUTOFF

- A. After driving, pile butts shall be cut-off to the required elevation on a neat horizontal plane and the cut-off portions shall be removed from the job site.

3.9 MISSING PILES

- A. Contractor shall be held responsible for any pile omitted; and missing piles at whatever stage of work discovered shall be provided without extra cost to the Owner.

END OF SECTION

ASPHALT PAVING**SECTION 321216****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Hot-mix asphalt patching.
- B. Hot-mix asphalt paving.

1.2 RELATED SECTIONS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Include technical data and tested physical and performance properties.
- C. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- D. Job-Mix Designs: For each job mix proposed for the Work.
- E. Paving Fabric: 12 by 12 inches (300 by 300 mm) minimum.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: For each paving material, by a qualified testing agency.
- B. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
- B. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
- C. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
- D. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
- E. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: [ASTM D 1073] [or] [AASHTO M 29], sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
- D. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- E. Mineral Filler: [ASTM D 242/D 242M] [or] [AASHTO M 17], rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320, [PG 64-22] [PG 58-28] [PG 70-22] <Insert performance grade>.
- B. Asphalt Cement: [ASTM D 3381/D 3381M for viscosity-graded material] [ASTM D 946/D 946M for penetration-graded material].
- C. Cutback Prime Coat: ASTM D 2027, medium-curing cutback asphalt, [MC-30 or MC-70] [MC-250].
- D. Emulsified Asphalt Prime Coat: [ASTM D 977] [or] [AASHTO M 140] emulsified asphalt, or [ASTM D 2397] [or] [AASHTO M 208] cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- E. Tack Coat: [ASTM D 977] [or] [AASHTO M 140] emulsified asphalt, or [ASTM D 2397] [or] [AASHTO M 208] cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- F. Water: Potable.
- G. Undersealing Asphalt: ASTM D 3141/D 3141M; pumping consistency.

2.3 AUXILIARY MATERIALS

- A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled [tires] [asphalt shingles] [or] [glass] from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.
- B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

- C. Sand: [ASTM D 1073] [or] [AASHTO M 29], Grade No. 2 or No. 3.
- D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- E. Joint Sealant: [ASTM D 6690] [or] [AASHTO M 324], [Type I] [Type II or III] [Type IV], hot-applied, single-component, polymer-modified bituminous sealant.

2.4 MIXES

- A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [10] [20] [40] <Insert number> percent or more than [15] [25] [50] <Insert number> percent by weight.
- B. Surface Course Limit: Recycled content no more than [10] <Insert number> percent by weight.
- C. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes [approved by authorities having jurisdiction] [; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types";] and complying with the following requirements:
 - 1. Base Course: <Insert mix designation>.
 - 2. Surface Course: <Insert mix designation>.
- D. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
- E. Emulsified-Asphalt Slurry: ASTM D 3910, [Type 1] [Type 2] [Type 3].

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- C. Completely proof-roll subgrade in one direction[, repeating proof-rolling in direction perpendicular to first direction]. Limit vehicle speed to 3 mph (5 km/h).
- D. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
- E. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- F. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

- A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseal concrete pieces firmly.
- C. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseal pieces firmly.
- D. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- E. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
- F. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
- G. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- H. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
- I. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.
- B. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.
- C. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of [1/4 inch (6 mm)] <Insert dimension>.
- D. Clean cracks and joints in existing hot-mix asphalt pavement.
- E. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

- F. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
- C. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- D. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
- E. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
- F. Protect primed substrate from damage until ready to receive paving.
- G. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth (0.5 to 1.40 L/sq. m per 25 mm depth). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
- H. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
- I. Protect primed substrate from damage until ready to receive paving.
- J. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
- K. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
- L. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 PAVING GEOTEXTILE INSTALLATION

- A. Apply [tack coat] [asphalt binder] [asphalt cement] uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd. (0.8 to 1.2 L/sq. m).
- B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches (100 mm) and transverse joints 6 inches (150 mm).

- C. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.

3.6 PLACING HOT-MIX ASPHALT

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
- B. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
- C. Place hot-mix asphalt surface course in single lift.
- D. Spread mix at a minimum temperature of 250 deg F (121 deg C).
- E. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
- F. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- G. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
- H. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches (25 to 38 mm) from strip to strip to ensure proper compaction of mix along longitudinal joints.
- I. Complete a section of asphalt base course before placing asphalt surface course.
- J. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
- B. Clean contact surfaces and apply tack coat to joints.
- C. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
- D. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
- E. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints [using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."] [as shown on Drawings.] <Insert joint requirement.>

- F. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
- G. Compact asphalt at joints to a density within 2 percent of specified course density.

3.8 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
- B. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
- C. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- D. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
- E. Average Density: 96 percent of reference laboratory density according to [ASTM D 6927] [or] [AASHTO T 245], but not less than 94 percent or greater than 100 percent.
- F. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.
- G. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- H. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- I. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- J. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- K. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
- B. Base Course: Plus or minus 1/2 inch (13 mm).
- C. Surface Course: Plus 1/4 inch (6 mm), no minus.

- D. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
- E. Base Course: [1/4 inch (6 mm)]
- F. Surface Course: [1/8 inch (3 mm)]
- G. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: [Owner will engage] [Engage] a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to [ASTM D 979] [or] [AASHTO T 168].
- E. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
- F. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
- G. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than three cores taken.
- H. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- I. Replace and compact hot-mix asphalt where core tests were taken.
- J. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 WASTE HANDLING

General: Handle asphalt-paving waste according to approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION

CONCRETE PAVING**SECTION 321313****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes Concrete Paving Including the Following:
 - 1. Driveways.
 - 2. Roadways.
 - 3. Parking lots.
 - 4. Curbs and gutters.
 - 5. Walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.
 - 5. Curing compounds.
 - 6. Applied finish materials.
 - 7. Bonding agent or epoxy adhesive.
 - 8. Joint fillers.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

1.7 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

1.8 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

1.9 FORMS

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

1.10 STEEL REINFORCEMENT

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, fabricated from galvanized-steel wire into flat sheets.
- C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- D. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60 deformed bars; assembled with clips.

- E. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.

1.11 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
- C. Portland Cement: ASTM C 150/C 150M, gray or white portland cement Type I, Type II, or Type III.
- D. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches, 1 inch, or 3/4 inch nominal.
- E. Air-Entraining Admixture: ASTM C 260/C 260M.
- F. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- G. Water: Potable and complying with ASTM C 94/C 94M.

1.12 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

1.13 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork in preformed strips.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

- C. Bonding agent in "Bonding Agent" Paragraph below may be used directly from container or as an admixture in cement or sand-cement slurry.
- D. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- E. Epoxy-Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements.

1.14 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture or high-range, water-reducing admixture in concrete as required for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- E. Concrete Mixtures: Normal-weight concrete.
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum W/C Ratio at Point of Placement: 0.50.
 - 3. Slump Limit: 5 inches, plus or minus 1 inch.

1.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94 and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 2 - EXECUTION

2.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earthwork."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

2.3 EDGE FORMS AND SCREED CONSTRUCTION

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

2.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

2.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
 2. Provide tie bars at sides of paving strips where indicated.
 3. Butt Joints: Use bonding agent or epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Control Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:
 - 1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of control joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
 - 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

2.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- F. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

- G. Screed paving surface with a straightedge and strike off.
- H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- I. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
- J. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

2.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
 - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 - 2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
 - 3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch-deep with a stiff-bristled broom, perpendicular to line of traffic.

2.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. If evaporation rate in "Evaporation Retarder" Paragraph below is exceeded, ACI 305R states that plastic shrinkage cracking is probable. See manufacturers' literature or ACI 305R for estimated moisture-loss chart that relates relative humidity, air and concrete temperature, and wind velocity to rate of evaporation.
- D. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h 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.
- E. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- F. Do not use curing compound on surfaces to be covered by unit pavers, tiles, or other materials set in mortar.
- G. Curing Methods: Cure concrete by moisture curing moisture-retaining-cover, curing compound or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or 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.

2.9 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 1. Elevation: 3/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-feet-long; unlevel straightedge not to exceed 1/2 inch.
 4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
 5. Lateral Alignment and Spacing of Dowels: 1 inch.
 6. Vertical Alignment of Dowels: 1/4 inch.
 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
 8. Joint Spacing: 3 inches.
 9. Contraction Joint Depth: Plus 1/4 inch, no minus.
 10. Joint Width: Plus 1/8 inch, no minus.

2.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
 1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231/C 231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- H. Concrete paving will be considered defective if it does not pass tests and inspections.
- I. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- J. Prepare test and inspection reports.

2.11 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 14 00
UNIT PAVING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Concrete Paver on Grade
 - 2. Pool Coping

1.03 ACTION SUBMITTALS

- A. Product Data: For materials other than water and aggregates.
- B. Samples for Verification:
 - 1. Full-size units of each type of unit paver indicated.
 - 2. Joint materials involving color selection.

1.04 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Preinstallation Conference: Conduct conference at Project site two weeks prior to installation.

1.06 FIELD CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.
- B. Weather Limitations for Bituminous Setting Bed: Install bituminous setting bed only when ambient temperature is above 40 deg F (4 deg C) and when base is dry.
- C. Weather Limitations for Mortar and Grout:
 - 1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and higher.

PART 2 PRODUCTS

2.01 CONCRETE PAVERS ON GRADE

- A. Concrete Pavers: Precast concrete paving units shall be precast concrete, consisting of Portland cement, aggregate, and color admixture.
- B. Properties:
 - 1. Portland Cement: ASTM C 150, Type III, high early strength.
 - 2. Aggregate: ASTM C 33.
 - 3. Other Constituents: Coloring pigments, integral water repellents, etc., shall be previously established as suitable for use in concrete and either shall conform to ASTM Standards where applicable, or shall be shown by test or experience not to be detrimental to the durability of the concrete.
 - 4. Aggregate for exposed aggregate surface: As selected.
 - 5. Manufacturers: Subject to compliance with requirements, provide products by the following:

Keystone Hardscape. 29095 Krentel Rd, Lacombe, LA 70445. Phone: (985)789-1590.
Email: scott.harvey@keystonehardscapes.com
 - 6. Concrete Paver, Vehicular
 - a. Size: 8 inch x 4 inch
 - b. Thickness: 60 mm
 - c. Color: To be selected from manufacturer's standard color options.

2.02 POOL COPING:

- A. Size: 2 inch x 12 inch x 24 inch
- B. Materials: Precast Coping
- C. Color: To be selected from manufacturer's standard color options.
- D. Manufacturer:

- 1. Npt

Website: <https://www.nptpool.com/>

2.03 ACCESSORIES

- A. Mortar Joint: Commercial Grade Type S Mortar, ASTM C270 and C1714

2.04 MORTAR SETTING BED MATERIAL:

- A. Portland Cement: ASTM C 150/C 150M, Type I or Type II.
- B. Sand: ASTM C 144.
- C. Latex Additive: [Manufacturer's standard] [acrylic resin] [or] [styrene-butadiene-rubber] water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.

PART 3 EXECUTION

3.01 EXAMINATION

- D. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

3.02 PREPARATION

- E. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
- F. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

3.03 INSTALLATION, GENERAL

- G. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.
- H. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- I. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
 - 1. For concrete pavers, a block splitter may be used.
- J. Tolerances: Do not exceed 1/32-inch unit-to-unit offset from flush (lippage) or 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving.

3.05 REPAIRING AND CLEANING

- N. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units prior to substantial completion. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION 32 14 00

CONCRETE CURB

SECTION 321613

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This work consists of construction and/or installation of a concrete curb and gutter.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONCRETE CURB, STRAIGHT OR CIRCULAR

- A. Concrete curb shall be either mountable concrete curb or barrier concrete curb. The type of concrete curb or concrete curb to be provided shall be as shown on plans.
- B. The concrete used shall be mixed with the same materials, having the same compressive strength and shall be cured in the same manner as specified for "Reinforced Concrete Roadway Pavements".
- C. Where it is required to construct concrete curb and gutterbottom, the curb and gutterbottom must be poured monolithically.
- D. Undowelled contraction joints shall be placed through the entire width of the concrete curb, at no greater than fifteen (15') foot intervals. Contraction joints shall be formed by a jointing tool or other acceptable means, having a 2" depth and 1/4" width and filled with silicone sealant or an approved joint sealant.
- E. Dowelled expansion joints shall be placed at intersections, not to exceed three hundred (300') foot intervals, and/or as indicated on the plans.
- F. Pre-moulded joint filler shall be placed through the entire section of the concrete curb. The concrete curb shall be reinforced in accordance with the standard plans.
- G. The forms shall provide for the dimensions specified and must be set to the established grades. After placing, concrete shall be worked with a float, in a manner that will thoroughly compact it and provide a surface free from depressions or irregularities of any kind.

END OF SECTION

SIDEWALKS**SECTION 321623****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This work consists of construction of sidewalks and related access features

1.2 RELATED REQUIREMENTS

- A. Sidewalks and ramps shall comply with the most current regulations for Titles II and III of the Americans with Disabilities Act of 1990 (ADA) and applicable accessibility standards published by the Department of Justice (the 2010 ADA Standards for Accessible Design, "2010 Standards", or later).

PART 2 - PRODUCTS (NOT USED)**PART 3 - EXECUTION****3.1 SIDEWALKS AND RAMP ACCESSIBILITY**

- A. An ADA curb ramp is a short ramp cutting through a curb or built up to it to provide an accessible path of travel.
1. On a curb ramp, the running slope is the slope in the direction of pedestrian travel on the ramp run and must be 8.33 percent (1:12) or less. Where provided, curb ramp flares shall not be steeper than 1:10.
 2. On a curb ramp, the cross slope is the slope perpendicular to [across] the direction of pedestrian travel on the ramp run and the cross slope of the ramp run itself may not exceed 2 percent (1:50).
 3. The ramp, or ramp run, must be at least 48 inches wide, not including the flared sides. The ramp run must have detectable warnings – i.e., dome-shaped bumps – that extend the full width and depth of the ramp.
 4. Transitions from the ramp to the walkway, gutter, and street must be flush (level) and free of abrupt level changes. The gutter must have a slope of no more than 5 percent (1:20) toward the ramp.
 5. Landings shall be provided at the tops of curb ramps. The minimum landing clear length shall be 48 inches. The landing clear width shall be at least as wide as the curb ramp, excluding flared sides, leading to the landing.
 6. Diagonal or corner type curb ramps with returned curbs or other well-defined edges shall have the edges parallel to the direction of pedestrian flow. The bottom of diagonal curb ramps shall have a clear space of 48 inches minimum outside active traffic lanes of the roadway. Diagonal curb ramps provided at marked crossings shall provide the 48 inches minimum clear space within the markings. Diagonal curb ramps with flared sides shall have a segment of curb 24 inches long minimum, located on each side of the curb ramp and within the marked crossing.
- B. Raised islands in crossings shall be cut through level with the street or have curb ramps at both sides. Each curb ramp shall have a level area 48 inches long minimum by 48 inches wide minimum at the top of the curb ramp in the part of the island intersected by the crossings. Each 48 inch minimum by 48 inch minimum area shall be oriented so that the 48 inch minimum length is in the direction of the running slope of the curb ramp it serves. The 48 inch minimum by 48 inch minimum areas and the accessible route shall be permitted to overlap.

- C. The running slope of sidewalks must be 5 percent (1:20) or less. The cross slope of sidewalks must be 2 percent (1:50) or less. The clear width of sidewalks shall be at least 48 inches and a sidewalk with a clear width of less than 60 inches shall provide passing spaces at intervals of 200 feet maximum. If the longitudinal slope of the sidewalk exceeds 1:20, it is considered a ramp and a level landing must be provided for every 30-inch change in elevation.

3.2 PORTLAND CEMENT CONCRETE SIDEWALK OR BANQUETTE PAVEMENT

- A. Portland cement concrete sidewalk or banquette pavement shall be of such widths and fixed at such elevations as shown on the project drawings. They shall consist of a one course Portland cement concrete pavement four (4") inches in thickness.
 - 1. The concrete shall have a minimum compressive strength of three thousand (3,000) psi. at twenty-eight (28) days. The minimum cement content shall be five and one-half (5-1/2) bags per cubic yard of concrete. The maximum water content, including free water in the aggregate, shall not be greater than six (6) gallons per bag of cement. The consistency of concrete shall be such as to have a slump of from two (2") inches to four (4") inches.
 - 2. Sidewalks or banquettes shall be reinforced with 6 X 6 – W2.9 X W2.9 wire mesh weighing forty-two (42) pounds per hundred square feet.
- B. In preparing the subgrade on which the Portland cement concrete sidewalk or banquette pavement will be placed, all soft and spongy places shall be removed and all depressions filled with suitable materials which shall be thoroughly compacted in layers not exceeding six (6") inches in thickness. The subgrade shall be thoroughly tamped until it is brought to a firm, unyielding surface. It shall have a slope in conformity with the slope of the finished surface of the Portland cement concrete sidewalk or banquette pavement.
- C. When the Portland cement concrete sidewalk or banquette pavement is to be constructed over an old path composed of gravel or cinder, the old path shall be entirely loosened, the material spread for the full width of the subgrade and compacted as specified.
- D. For fill material, the use of muck, quicksand, soft clay, spongy or perishable material is prohibited. The top of all fills shall extend at least two (2') feet beyond the sidewalk or banquette pavement on each side and the sides shall have a maximum slope not greater than one (1) vertical to one and one-half (1-1/2) horizontal before any Portland cement concrete sidewalk or banquette pavement will be allowed to be placed thereon.
- E. Concrete shall be of the strength and consistency herein before described. The method of mixing and placing shall be in conformance with ACI requirements for Portland cement concrete pavement. Concrete that does not flush readily shall be removed immediately from the grade and not re-used, except that the coarse aggregate can be salvaged by washing.
- F. After mixing, the concrete shall be handled rapidly and the successive batches deposited in a continuous operation completing individual sections to the required depth and width. The forms shall be filled and the concrete struck off and tamped. The method of placing the various sections shall be such as to produce a straight clean joint between them so as to make each section an independent unit. If dirt, dust or other foreign substances collect on the surface, they shall be removed before the trowelling is started.
- G. After the concrete has been tamped, it will be brought to the established grade by means of a strike board, and it will then be worked with a wood float in a manner which will thoroughly compact it and provide a surface free from depressions or irregularities of any

kind. Excessive working shall be avoided. In no case shall dry cement and sand be sprinkled on the surface. The surface edges of all slabs shall be rounded to a radius of one-half (1/2") inch.

- H. Portland cement concrete sidewalk or banquette pavement shall be divided into blocks of such dimensions, by means of a joiner or grooves, as shown on the project drawings. Weakened planes shall be formed by a jointing tool or other acceptable means. Weakened planes shall extend into concrete for at least one-quarter (1/4") inch of the depth and shall be approximately one-eighth (1/8") inch wide. Spacing of weakened planes shall be equal to the width of the sidewalk. Transverse expansion joints shall be made at intervals of about ninety (90') feet and constructed in accordance with the project drawings.
- I. All expansion joints shall be carefully made so as to be truly perpendicular to the surface of the sidewalk or banquette pavement and at right angles to the edge of same. The surface of the concrete adjacent to expansion joints shall be finished with a wood float, which is divided through the center and which will permit finishing on both sides of the joint at the same time. An expansion joint shall also be provided adjacent to solid walls of masonry, behind curbs, at intersections and at footlaps. Where posts or poles fall within the limit of the sidewalk or banquette pavement, an expansion joint not less than one-half (1/2") inch in width shall be placed around said posts or poles and filled with joint filler. In the case of expansion joints adjacent to masonry walls, at footlaps and around posts or poles, the joint filler shall not extend above the surfaces of the sidewalk or banquette pavement and any excess filler that so protrudes shall be cut off and made flush with the sidewalk or banquette pavement.
- J. As soon as the finished work has hardened sufficiently to prevent damage, the surface of the walk shall be covered with curing compound. The freshly finished work shall be protected from hot sun and drying winds until it can be covered as above specified. Curing by application of chemicals or some other method of curing may be used upon the approval of the EOR. The concrete surface must not be damaged or pitted by raindrops and the Contractor shall provide and use, where necessary, sufficient tarpaulins to completely cover all sections that have been placed within the preceding twelve (12) hours. The Contractor shall erect and maintain suitable barriers to protect the walk from traffic, and any section damaged from traffic or other causes, shall be repaired or replaced by the Contractor at his own expense. The walk shall not be opened to traffic until the prescribed curing period has expired.
- K. Portland cement concrete sidewalk or banquette pavement at intersections, including ramps for the handicapped, shall be six (6") inches thick and placed as above specified.

END OF SECTION

DRIVEWAYS

SECTION 321633

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This work consists of construction of driveways and related access features

1.2 RELATED REQUIREMENTS

- A. Ramps shall comply with the most current regulations for Titles II and III of the Americans with Disabilities Act of 1990 (ADA) and applicable accessibility standards published by the Department of Justice (the 2010 ADA Standards for Accessible Design, "2010 Standards", or later).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DRIVEWAYS

- A. Driveways shall be constructed of such lengths and widths and at such points as shown on the plans or as may be designated by the DPW Director.
- B. Where driveways are to be constructed within the sidewalk area, where lip concrete curb is installed, the details of the driveways shall be as shown on Standard Plans for Standard Mountable Driveway or Heavy Duty Mountable Curb Driveway, as specified in the proposal.
- C. All standard driveways shall be six (6") inches and all heavy duty driveways shall be eight (8") inches in thickness. Driveways shall be constructed of Portland cement concrete having a minimum compressive strength of three thousand (3,000) psi. at twenty-eight (28) days. The minimum cement content shall be five and one-half (5-1/2) bags per cubic yard of concrete. The maximum water content, including free water in the aggregate, shall not be greater than six (6) gallons per bag of cement. The consistency of the concrete shall be such as to have a slump of from two (2") inches to four (4") inches.
- D. Driveways shall be reinforced with 6 X 12 – W7.5 X W6.5 welded wire fabric weighing seventy-seven (77) pounds per hundred (100) square feet.
- E. Expansion joints shall be provided where shown on Standard Plans or as may be otherwise directed.
- F. Weakened planes shall be formed by a jointing tool or other acceptable means. Weakened planes shall extend into concrete for at least 1/4 of the depth and shall be approximately 1/8 inch wide.
- G. A longitudinal weakened plane shall be formed along the centerline of drives more than 16 feet wide, and transverse weakened planes shall be formed at not more than 16-foot intervals.
- H. The subgrade on which the driveways are to rest shall be thoroughly rolled or tamped so as to be uniformly compacted and solidified. The finished grade shall be smooth, even, well-graded and exactly parallel to the finished surface of the driveway.
- I. Immediately after placing and tamping the concrete in place, it will be brought to the established grade by means of a strike board. Finishing shall be completed by use of a soft-haired brush, moved lightly over the surface in the direction of the width of the

driveway. Joints are to be straight and square, in good alignment and edges finished by a joiner, so as to avoid sharp corners.

END OF SECTION

PAVEMENT MARKINGS

SECTION 321723

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Preparation for painting pavements and curbs.
- B. Painting for street markings such as center lines and crosswalks.
- C. Painting parking stalls, marking fire lane and walkways, symbols, and lettering.

1.2 REFERENCE STANDARDS

- A. DPW Standard Specifications – City of New Orleans General Specifications
- B. DPW Standard Plans – City of New Orleans Standard Details
- C. MUTCD – Latest edition of Manual on Uniform Traffic Control Devices for Streets and Highways with latest revisions per DPW.

1.3 SUBMITTALS

- A. Product Data: Pavement marking materials and colors.

1.4 QUALITY ASSURANCE

- A. Pre-Installation Meeting:
 - 1. Coordinate and attend meeting prior to painting.
 - 2. Attendees to include paving contractor/installer, Owner, and Engineer.
 - 3. Agenda:
 - a. Owner expectations and installation requirements.
 - b. Sequence of Work, schedule, and responsibilities.
 - c. Existing pavement conditions and whether hot sprayed thermoplastic is suitable application for a parking lot because of pavement conditions.

1.5 REGULATORY REQUIREMENTS

- A. Comply with DPW standards.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Pavement must be clean and dry.
- B. Comply with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 PAINT

- A. Streets/Roads, including center lines, edge/fog lines, stop-bars:
 - 1. ReflectORIZED traffic line paint for street striping in accordance with DPW Standard Specification Section C732.03. Low VOC (volatile organic compound) solvent-based or waterborne paint.
- B. Parking Stalls and ADA Access Aisles - Outdoor:
 - 2. ReflectORIZED traffic line paint for parking stalls in accordance with DPW Standard Specification Section C732.03. Low VOC (volatile organic compound) solvent-based or waterborne paint.
- C. Parking Stalls and ADA Access Aisles - Indoor:

3. Non-reflectorized traffic line paint for parking stalls in accordance with DPW Standard Specification Section C732.03. Low VOC (volatile organic compound) solvent-based or waterborne paint.
- B. Crosswalks, Directional Arrows, Pedestrian Pathways, No-Parking Markings, Symbols, Lettering, Parking Stall End Bands, and all other Pavement Markings:
 1. Type A – Liquid Hot Applied Thermoplastic in accordance with DPW Standard Specification Section C732.03.
- D. Color:
 1. Street center lines: Yellow.
 2. Fire lane markings: Yellow, Comply with City of New Orleans Requirements.
 3. All other applications: White.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify paving and curbing is complete, and surface is ready to receive painting and striping.
- B. Verify paving and curbing is sufficiently cured.
- C. Verify surfaces to receive painting and striping are dry and free of loose debris.
- D. Verify weather forecast during planned time of placement is within weather limitations.
- E. For parking lots, verify distance between curbs to ensure adequate width for the indicated number of stalls.
- F. For thermoplastic application on existing pavement, assess pavement to verify whether pavement conditions are suitable for hot sprayed thermoplastic.

3.2 PREPARATION

- A. Clean and prepare surface for receiving paint in accordance with DPW Standard Specification Section C732.03.
 1. New pavement:
 - a. Ensure pavement is sufficiently cured.
 - b. Air blast pavement with a high-pressure system to remove extraneous and loose materials.
 2. Existing pavement:
 - a. Remove existing pavement markings per DPW Standard Specification Section C732.03
 - b. Cleaning and removal methods used shall not damage pavement surface. Grinding to remove pavement markings is not allowed.
 - c. Air blast pavement with a high-pressure system to remove extraneous and loose materials.
- B. Layout lines and symbols to spacing and locations shown on Drawings.
- C. Apply primer as recommended by the manufacturer to the area receiving pavement markings.

3.3 CONSTRUCTION

- A. Comply with DPW Standard Specification Section C732.03
- B. Ensure that both the pavement surface and the air temperature during application are not lower than 50 degrees Fahrenheit.

- C. Provide preliminary layout for Owner review prior to install of permanent pavement markings. Layout parking stalls at locations and extents as shown on Drawings. Make sure dimensions from center line to center line of parking stalls match dimensions as shown on Drawings. Do not install pavement marking without Owner's review of the layout.
- D. Install pavement markings at locations, spacing, size, and extents as shown on Drawings.
- E. Apply pavement marking materials to clean and dry surfaces.
- F. Apply pavement marking materials in accordance to the material manufacturer's requirements and recommendations.
- G. For parallel double lines, place painting material in one pass.
- H. Place pavement marking lines parallel and true to line.
- I. Ensure line ends square and clean.
- J. Ensure the top of pavement marking smooth and uniform.
- K. For paint, apply two applications of paint to pavement markings. Ensure the second application of paint squarely on top of the first application. Time period between two paint applications: per DPW Standard Specification Section C732.03
- L. Ladder Type Crosswalks: Spread white sharp sand over fresh marking materials at a rate of approximately one pound per twenty square feet.
- M. Paint Application Thickness: Per DPW Standard Specification Section C732.03.
- N. Glass Beads Application: For hot sprayed thermoplastic, apply glass beads DPW Standard Specification Section C732.03. Application rate per manufacturer's recommendations.

3.4 TOLERANCES

- A. Width of line: Must not be less than the specified line width or greater than the specified line width by 1/4 inch.
- B. Thickness: 10 percent plus or minus.
- C. Parking stall and ADA path width: 1/4 inch from center line to center line.

3.5 FIELD QUALITY CONTROL

- A. Inspection: Owner will observe Work at the following milestones:
- B. After completion of surface preparation and before installing preliminary pavement marking layouts.
- C. After completion of preliminary pavement marking layouts. Owner will check dimensions of parking stall layouts.
- D. After completion of pavement markings.

3.6 PROTECTION

- A. Protect painted surfaces until dry.

END OF SECTION

SANITARY SEWAGE**SECTION 333000****PART 1 - GENERAL**

- A. The work shall be in accordance with the Sewerage & Water Board Specifications and Standard Plans except as noted.
- B. The Contractor shall furnish all labor, materials, equipment and supervision required for:
 - Installation of new sewer mains, sewer house connections and manholes.
 - Installation/rehabilitation of manholes and cleaning of new replaced or restored mains and manholes.
 - All work to be done on Sewerage Systems will be as shown on the plans and as directed by the Director. All workmanship, materials and tests shall conform with Section D of the General Specifications of the Sewerage & Water Board and Sewerage & Water Board Standard Drawing No. 7260-S, except as noted hereinafter. The Contractor shall notify the Chief of Network Engineering of the Sewerage & Water Board in writing not less than three or more than ten working days in advance of starting the job, in order to allow for scheduling the inspection of the work. Failure to do so prior to starting work will result in the Contractor being required to expose the bedding on all pipe previously installed without Sewerage & Water Board inspection.

PART 2 - MATERIALS

- A. All workmanship and materials required to perform this work, shall conform to the current General Specifications of the Sewerage & Water Board and the Department of Public Works except as noted hereinafter.
- B. The Contractor performing work covered in this section shall be required to coordinate his operations with the Sewerage & Water Board (Chief of Network Engineering) and other utilities prior to making any excavation so that the location of their services can be identified. The Contractor shall exercise caution in making excavations to avoid damage to these services and other utilities.
- C. The Contractor will be furnished with a list of the locations of water and sewer house connections from the Sewerage & Water Board. It will be the Contractor's responsibility to verify the location of these so as to avoid damage. Furnishing this information should not be construed as a waiver of the Contractor's liability, but rather an attempt on the part of the S&WB to minimize the Contractor's hazard. The existing house connections submitted in the lists are from S&WB records and could vary from the actual location. Any damage to the existing water, sewer and drain connections resulting from negligence will be repaired by the S&WB at the expense of the Contractor. The Contractor is also responsible for damage to other utilities and the property of others.
- D. Sewer house connections shall be tied into the new mains and replaced with new connections where needed.

PART 3 - INSTALLATION AND REHABILITATION OF SEWER MAINS**3.1 GENERAL**

- A. Work under this section shall consist of furnishing all labor and materials for the replacement, relocation and/or installation of sewer mains, installing new house connections, point repairs and performing all operations required for improving the sewer

system. The Contractor shall provide the necessary dewatering and by-passing required during execution of this work at no direct pay.

3.2 MATERIALS AND METHODS

- A. Pipe material for sewer mains shall be solid wall polyvinyl chloride (PVC) pipe. The solid wall PVC pipe 6" through 15" shall be manufactured in accordance with ASTM D-3034 specifications for a special gravity sewer pipe dimensions ratio (SDR) of 26. The fittings (tees, wyes, etc.) and bell stock for truss and solid wall PVC pipe shall have a thickness not less than that of the SDR-35 solid wall PVC pipe of the same inside diameter. PVC Sewer Mains sizes 18" through 27" shall be solid wall, PVC pipe conforming to ASTM F-679, Class T-1. PVC pipe shall be type PSM Vinyl Chloride (PVC) standard lengths with integral cast bells and elastomeric gaskets as recommended by the manufacturer and ASTM D-3212. The Sewerage & Water Board reserves the right to approve the type of material.
- B. The maximum allowed deflection for installed PVC sewer pipe is per the manufacturer recommendations. Newly installed pipe that exceeds this allowable deflection shall be removed and replaced with new pipe and reinstalled as per the above specifications at the Contractor's expense. The S&WB reserves the right to mandrel any and/or newly installed PVC sewer pipe. The Contractor will install the pull lines and pass the mandrel through the mains selected by the S&WB. The S&WB will provide the mandrels for all tests. The mandreling tests will occur after compacted backfill of the trenches. The Contractor shall bear the cost of mandreling re-testing if required and will be assessed \$100.00 for each occurrence in each section between manholes. In addition, cleaning and TV/video of the new PVC sewer lines (either in-service or not) will occur during final inspection after all paving is completed to verify the absence of construction debris. The Contractor shall bear all costs of cleaning and TV/video test or re-testing. It is required that a S&WB representative and the Contractor witness the actual mandreling test(s) and witness the real-time cleaning and TV/video test(s). The S&WB does not desire a copy of the videotape. Bedding and foundation for mains shall conform with S&WB Drawing No. 4697-E5-A except as noted below. Backfill and drainage fabric for mains shall be as noted below. Standard sheeting and bracing shall comply with DWG. 4697-E5A of the S&WB General Specifications. The same type and size pipe material must be installed between manholes.
- C. Installation of the solid wall PVC pipe shall conform to Section D of the Sewerage & Water Board General Specifications, "The Construction of Sewer" and the Plastic Pipe Association Specification UNI-B 78, "Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Sewer Pipe." The trench bottom shall be relatively smooth and free from rocks, roots, etc. After the sheeting and/or foundation lumber is placed, the pipe shall be laid on a smooth bed of approved bedding material mentioned below, compacted to a density of not less than 95% relative density, six inches deep for the full width of the trench.
- D. The bedding material shall be extended to six inches above the top of the pipe, well compacted (hand or mechanical) in six inch layers to not less than 95% relative density, as shown on the Standard Plans of the Department of Public Works. The bedding material shall be placed and consolidated under the pipe haunches to provide maximum side support to the pipe while avoiding displacement and misalignment of the pipe.
- E. Bedding material shall be 100% crushed aggregate listed on Qualified Product of the Louisiana Department of Transportation and Development and conforming to ASTM

D2321, class 1A Angular Material (1/4" to 1 1/2") and ASTM No. 57. The Sewerage & Water Board reserves the right to approve the type of bedding material.

- F. Backfill material shall be pumped sand and shall be placed at or near optimum moisture content and compacted according to one of the following procedures:
 - 1. Backfill material shall be placed in layers not to exceed 12 inches. Each layer shall be compacted to a minimum of 95% of maximum density using approved mechanical compaction equipment. Or,
 - 2. Backfill material may be placed in layers not exceeding 12 inches by thoroughly compacting each layer to 95% maximum density at or near optimum moisture content using approved mechanical compaction equipment, prior to placing a subsequent layer.
- G. The above backfill material and the compaction procedures shall be applied also for any service connections, and point repairs.
- H. Drainage fabric shall be installed around the bedding and under the sand backfill according to the Standard Plans. Fabric shall extend a minimum of twelve (12") inches on each side of the trench and shall be secured to each side in a manner acceptable to the Director.
- I. The Contractor shall provide the Director a sample of the fabric to be used on the project along with a copy of the manufacturer's minimum requirement specifications prior to the start of construction.
- J. The drainage fabric shall be installed around the bedding and under the sand backfill according to the Standard plans.

3.3 REPLACEMENT AND RELOCATION OF EXISTING SEWER MAINS, INSTALLATION OF NEW SEWER MAINS BETWEEN MANHOLES

- A. The Contractor shall furnish all materials, equipment and labor to remove the existing deteriorated main, (if any) install mains and fittings (wyes, tees, etc.), including appurtenances such as tie-ins to existing system, lumber foundation, bedding, backfilling, necessary dewatering and by-passing, during the execution of this work.
- B. Where the sewer main is relocated, the existing abandoned main must be filled and plugged where shown on the plans. Sand shall be filled into the sewer line to avoid caving in of the sewer line.
- C. All workmanship, materials and tests shall conform to Section D of the General Specifications of the S&WB, except as noted otherwise. The Contractor may use more than one crew in performing work in various sections of a system at a given time, provided he has the approval of the Director.
- D. The new sewer mains and house connections shall be installed at the elevations and locations indicated on the plans, unless changed by the S&WB. The Contractor shall schedule his work so that the sewer mains and house service connections between two manholes are completed before moving to another location (this will minimize the spillage of raw sewage into an open trench). The Contractor shall isolate the block where the work is in progress by plugging the upstream and downstream manholes. Should the sewerage build up to within three feet of the upstream manhole, or if directed by the S&WB, the Contractor shall pump the sewer liquid to the downstream manhole through by-pass pumping. No mains or lines shall be left open overnight; a temporary tie-in shall be made between the end of the new main and the existing, and plugs at manholes shall be removed so as to allow flow to continue until work is resumed.

- E. Where it is necessary to connect the sewers to existing manholes, the existing short bell pieces remaining in the wall of the manhole shall be broken out. A new short bell piece shall be inserted to the full thickness of the walls and permanently grouted in place (see S&WB Dwg. 6178-B6). The new short bell piece shall be a sand impregnated PVC stub grouted with a type three, high early strength cement, or quick setting EMBECO or similar material.
- F. If a PVC pipe is to be connected to a manhole or other concrete or brick structure, the Contractor shall use a sand impregnated PVC stub, grouted with cement grout as specified above, for the manhole connection.

3.4 POINT REPAIRS OF EXISTING SEWER MAINS

- A. The Contractor shall make point repairs to the lines at specific locations shown on the drawings and as listed in the proposal.
- B. Point repairs shall be made by either wet or dry type and shall conform to Section XII of NASSCO (National Association of Sewer Service Companies). The Contractor shall make an excavation to expose a base "ten (10') linear feet" of main, per point repair. Any additional footage of repair beyond the ten foot minimum for each point repair shall be approved by the Director.
- C. The Contractor is required to have all materials and equipment on hand prior to the start of excavation so that there will be a minimum of inconvenience to the residents. All trenches must be backfilled at the end of the day.

3.5 SEWER HOUSE CONNECTIONS

- A. New or replacement sewer house connections, where required, shall be six inch pipe extended from the main to the back of curb or to a point directed by the Director. Bedding and foundations required under sewer mains are not required under six (6") inch sewer house connections.
- B. The use of saddles to connect the house service to the main will not be permitted; all such connections shall be made using wye to tee fittings.
- C. The need for replacing these house services beyond the wye or tee connection will be determined by the Director. If the pipe beyond the wye or tee is in good condition, a tie in will be made at the fitting (wyes, tees, etc.). If the pipe beyond the wye or tee is in poor condition, a new house service will be installed from the main to the back of curb or to a point directed by the Director and tied into the existing house service at the point. All pipe and fittings shall be of the same material as the main, unless approved by the S&WB. The connection of any two dissimilar materials shall be accomplished by the installation of a "No-Hub" coupling, consisting of a neoprene sleeve and bushing adaptor and two stainless steel bands with STAINLESS STEEL SCREWS. The coupling shall be manufactured in strict accordance with Cast Iron Soil Pipe Institute Specifications C-301, latest revision, as manufactured by Tyler Pipe Company, Mission Clay Products Corps., Fernco, or approved equal.
- D. Where existing or proposed subsurface facilities conflict with existing sewer house connections, these same connections shall be adjusted to provide for adequate clearance in accordance with the S&WB Standard Specifications. No syphons will be permitted. Adjustment of sewer house connections shall comply with the above specifications for replacement of sewer house connections.

3.6 SANITARY SEWER MANHOLE

- A. New sanitary sewer manholes required when installing new sewer mains or relocating existing sewer mains shall be constructed in accordance with the applicable sections of the S&WB General Specifications and S&WB Standard Drawings No. 6178-B6, No. 6178-B-6A, and 3143-E-1.

3.7 INSPECTION

- A. At the completion of the point repair or installation of mains between manholes, and prior to final acceptance, the S&WB may inspect the mains with a remote control television unit. The Contractor shall assist by notifying the residents to refrain from use of these services during the inspection. The Contractor will be required to repair at his expense and in an approved manner, all defects in his workmanship disclosed by these tests and inspections before final acceptance.

END OF SECTION

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Horizontal-slide gates.
2. Gate operators, including controls.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete bases for gate operators, drives, and controls and post concrete fill.
2. Division 26 Sections for electrical service and connections for system disconnect switches and powered devices including, but not limited to, motor operators, controls, and limit switches.

1.2 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

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

- ##### B. Shop Drawings: For fencing and gates.

1. Include plans, elevations, sections, gate locations, post spacing, and mounting attachment details, and grounding details.
2. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
3. Wiring Diagrams: Include diagrams for power, signal, and control wiring.

- ##### C. Samples: For each fence material and for each color specified.

1. Provide Samples 12 inches in length for linear materials.

1.4 INFORMATIONAL SUBMITTALS

- ##### A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- ##### A. Maintenance Data: For gate operators to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- ##### A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Wind Loading:
 - 1. Design Wind Speed: As indicated on Drawings.
- B. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 DECORATIVE ALUMINUM FENCES AND GATES

- A. Decorative Aluminum Fences: Fences made from aluminum extrusions.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide "Majestic" style design by Ameristar Perimeter Security.
- B. Posts: Square extruded tubes.
 - 1. Horizontal-Slide Gate Posts: 6 by 6 inches with 0.125-inch wall thickness.
- C. Post Caps: Aluminum castings that cover entire top of posts.
- D. Rails: Extruded-aluminum channels, 1-1/2 by 1-1/2 inches.
- E. Pickets: Extruded-aluminum tubes, 3/4-inch square.
 - 1. Terminate tops of pickets at top rail for flush top appearance.
 - 2. Picket Spacing: 6 inches clear, maximum.
- F. Fasteners: Manufacturer's standard concealed fastening system.
- G. Fabrication: Assemble fences into sections by welding pickets to rails.
- H. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
- I. Finish: Powder coating.
- J. Gates:
 - 1. Gate Configuration: Single leaf.
 - a. Type: Cantilever slide, with external roller assemblies.
 - 2. Gate Frame Height: As indicated.
 - 3. Gate Opening Width: As indicated.
 - 4. Automated vehicular gates shall comply with ASTM F2200, Class II.
 - 5. Aluminum Frames and Bracing: Fabricate members from square tubing.
 - 6. Additional Rails: Provide as indicated, complying with requirements for fence rails.
 - 7. Infill: Comply with requirements for adjacent fence.
 - 8. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.
 - 9. Hardware: Manufacturer's standard locking devices, hangers, roller assemblies, and stops fabricated from galvanized malleable iron.

10. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.
11. Aluminum Finish: Baked enamel or powder coating.

2.3 GATE OPERATORS

- A. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
 1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 2. Provide operator with UL approval.
 3. Provide electronic components with built-in troubleshooting diagnostic feature.
 4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.
- B. Comply with NFPA 70.
- C. UL Standard: Manufacturer and label gate operators to comply with UL 325.
- D. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.
- E. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1 and the following:
 1. Voltage: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- F. Gate Operators: Concrete base mounted and as follows:
 1. Mechanical Slide Gate Operators:
 - a. Duty: Heavy duty, commercial/industrial.
 - b. Gate Speed: Minimum 45 feet per minute.
 - c. Maximum Gate Weight: 800 lb.
 - d. Frequency of Use: 25 cycles per hour.
 - e. Operating Type: Wheel-and-rail drive.
- G. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA ICS 6, Type 1 or NEMA ICS 6, Type 4 enclosure for pedestal mounting, and with space for additional optional equipment. Provide the following remote-control device(s):
 1. Card Reader: Functions only when authorized card is presented. Programmable, multiple [single]-code system; face-lighted unit fully visible at night.
 - a. Reader Type: Proximity.
 - b. Features: Timed antipassback; Capable of monitoring and auditing gate activity.
 2. Digital Keypad Entry Unit: Programmable, multiple-code capability of not less than 500 possible individual codes, consisting of 5-digit codes, and permitting four different access periods.

- a. Features: Timed antipassback Capable of monitoring and auditing gate activity.
 - b. Face-lighted unit with keyless-membrane keypad fully visible at night.
3. Telephone Entry System: Hands-free, voice-communication system for connection to building telephone system with digital-entry code activation of gate operator and auxiliary keypad entry.
 - a. Residential System: Designed to be wired to same line with telephone.
- H. Vehicle Loop Detector: System includes automatic closing timer with adjustable time delay, timer cutoff switch, and loop detector designed to hold gate open until traffic clears. System includes electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. System includes number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement, as recommended in writing by detection system manufacturer for function indicated, at location indicated on Drawings.
- I. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
 1. Action: Reverse gate in both opening and closing cycles and hold until clear of obstruction.
 2. Action: Stop gate in opening cycle and reverse gate in closing cycle and hold until clear of obstruction.
 3. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
 4. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.
- J. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.
- K. Emergency Release Mechanism: Quick-disconnect release of operator drive system of the following type, permitting manual operation if operator fails. Design system so control-circuit power is disconnected during manual operation.
- L. Operating Features:
 1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
 2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
- M. Accessories:
 1. Warning Module: Visual,-light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving; compliant with the United States Access Board's ADA-ABA Accessibility Guidelines.
 2. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system.
 - a. Fail-Safe: Gate opens and remains open until power is restored.
 3. Intercom System.

4. Instructional, Safety, and Warning Labels and Signs: Manufacturer's standard for components and features specified.
5. Equipment Bases/Pads: Precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

2.4 ALUMINUM

- A. Aluminum, General: Provide alloys and tempers with not less than the strength and durability properties of alloy and temper designated in paragraphs below for each aluminum form required.
- B. Extrusions: ASTM B221, Alloy 6063-T5.
- C. Tubing: ASTM B429/B429M, Alloy 6063-T6.
- D. Plate and Sheet: ASTM B209, Alloy 6061-T6.
- E. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.
- F. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.
- B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size.
- C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M and specifically recommended by manufacturer for exterior applications.

2.6 GROUNDING MATERIALS

- A. Comply with requirements of Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Grounding Conductors: Size as indicated on Drawings. Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 1. Material above Finished Grade: Aluminum.
 2. Material on or below Finished Grade: Copper.
 3. Bonding Jumpers: Braided copper tape, 1-5/8 inch wide and 1/16 inch thick, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- C. Grounding Connectors and Grounding Rods: Comply with UL 467.
 1. Connectors for Below-Grade Use: Exothermic-welded type.
 2. Grounding Rods: Copper-clad steel.

- a. Size: 5/8 by 96 inches.

2.7 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 2 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
 1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 DECORATIVE FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.
- B. Install fences by setting posts as indicated and fastening rails to posts. Peen threads of bolts after assembly to prevent removal.
- C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.
- D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Concealed Concrete: Top 2 inches below grade to allow covering with surface material. Slope top surface of concrete to drain water away from post.
 3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.

4. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch larger than outside diagonal dimension of post.
 - a. Extend posts at least 5 inches into concrete.
 - b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.
5. Space posts uniformly at 6 feet o.c.

3.4 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GATE OPERATOR INSTALLATION

- A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
- B. Excavation for Support Posts, Pedestals, and Concrete Bases: Hand-excavate holes for bases in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.
- C. Concrete Bases: Cast-in-place or precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.
- D. Vehicle Loop Detector System: Cut grooves in pavement and bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.
- E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.6 GROUNDING AND BONDING

- A. Comply with Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:
 1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
 - a. Gates and Other Fence Openings: Ground fence on each side of opening.
 - 1) Bond metal gates to gate posts.
 - 2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.
- C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

- D. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
- E. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
- F. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- G. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- H. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 - 1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
 - 2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
 - 3. Report: Prepare test reports of grounding resistance at each test location certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

3.8 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, and limit switches.

1. Hydraulic Operators: Purge operating system, adjust pressure and fluid levels, and check for leaks.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lubricate hardware, gate operators, and other moving parts.

3.9 DEMONSTRATION

A. Train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION

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SECTION 323119 - WOOD FENCES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SUMMARY

- A. Section includes all labor, materials, equipment and services necessary to complete the assemblies as shown on the drawings and/or specified herein, including but not necessarily limited to the following:
 - 1. Wood Fence: 8 feet & 6 Feet
 - 2. Gate: 8 feet & 6 Feet

1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. THE CONTRACT Documents are complementary, and what is required by one shall be as binding as if required by all.

1.4 EXAMINATION OF CONDITIONS

- A. The Contractor shall fully inform himself of existing conditions of the site before submitting his bid, and shall be fully responsible for carrying out all site work required to fully and properly execute the work of the Contract, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed.
- B. Plans, surveys, measurements and dimensions under which the work is to be performed are believed to be correct to the best of the Landscape Architect's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found therein.

1.5 ACTION SUBMITTALS

- A. Certificates of Inspection: Issued by lumber grading agency for exposed timber not marked with grade stamp.
- B. Product Data: Provide manufacturer's product data showing installation and limitations in use.
- C. Samples: Prior to ordering the below listed materials, submit representative samples to the Landscape Architect for selection and approval as follows. Do not order materials until the Landscape Architect's approval has been obtained. Delivered materials shall closely match the approved samples. Submit

duplicate samples of each type listed below showing full range of color variation, finish and texture that can be expected in the permanent work:

1. Wood planks: Two (2) samples minimum, 12” long samples for each size specified on the drawings, showing the full range of color and finish expected in the final work. Label each sample with job name, supplier, color, and finish.
 2. 4” Square x 12” Steel Post segment, with cap and vertical channel, showing color and finish.
- D. Shop Drawings: For fences and gates. Include plans, elevations, sections, details, and attachments to other work. All shop drawings shall reflect actual measurements and grades as verified on site. Notify Landscape Architect immediately if work in place does not reflect conditions indicated in design drawings.
- E. Maintenance Data: Contractor shall submit data for long-term maintenance.
- F. All submittals, samples and shop drawings shall comply with Section 013300 - “Submittal Procedures”.

1.6 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer’s instructions.
- B. Installer qualifications: Use adequate numbers of skilled workers who are trained in the necessary crafts and who are completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.
1. Minimum Years of Experience: 5 years.
- C. Source limitations: Obtain each type of lumber and fasteners from one source with resources to provide a sufficient quantity of materials and products of consistent quality in appearance and physical properties.
- D. Critical Path Processing:
1. CRITICAL PATH PROCESSING: The Contractor shall be responsible for recognizing that these critical project materials warrant timely attention, that the procurement process to achieve approved materials warrant timely attention, that the procurement process to achieve approved materials SHALL BE CONSIDERED A LONG LEAD TIME ITEM. Under no circumstances shall failure to comply with all specification requirements be a reason for a substitution of unacceptable material(s).
- E. Layout and Grading: After staking out the work, and before beginning final construction, obtain the Landscape Architect’s Approval for layout and grades.
1. The Contractor shall stake out the work in sufficient detail for evaluation by the Landscape Architect.
 2. The Landscape Architect shall be permitted to make reasonable adjustments to layout and grading without further compensation to the Contractor.
- F. Mock-Ups/Sample Panels: Upon approval of all materials, the Contractor shall construct sample panels on site in the minimum size indicated below. Each sample panel shall be large enough to display typical characteristics of each item and type of work. Construct Sample panels concurrently to aid in review of all materials. The Landscape Architect must approve the visual characteristics, quality of workmanship, and methods of installation before final work is started. If the original sample is not approved, the Contractor shall provide additional samples, as required, at no cost to the Owner until an approved sample is obtained. The approved sample shall become the standard for the entire job. Sample panel shall not be

constructed on a location becoming part of the final work, unless otherwise noted, and shall remain undisturbed until all work is completed. Sample panels shall be constructed at the same time and erected in a location approved by the Landscape Architect and Construction Manager. Contractor shall completely remove any panels not set in place as part of the final work from site upon final acceptance of work.

1. Fence: Steel framing, and footings, independent sample, 6' x 6' minimum panel showing portions of the pattern and intersections as determined by the Landscape Architect.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review.
 1. Factory mark each item with grade stamp of grading agency.
 2. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece.
 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Regional Materials: Wood products shall be milled within 500 miles of Project site from wood that has been harvested within 500 miles of Project site.
- C. Maximum Moisture Content:
 1. Boards: 15 percent.

2.2 FENCE & GATE WOOD BOARDS:

- A. Dimension: Refer to drawings.
- B. Shape, species and grades:
 1. #1 Southern pine.
 2. Shape: Eased/Chamfered Edge

2.3 FENCE POST, VERTICAL CHANNELS, SCREWS, CAPS, BOTS, AND SPACER

- A. Dimension: Refer to drawings.
- B. Materials: Refer to drawings
- C. Mounting: Refer to drawings
- D. Color: Black
- E. Manufacturer:

Fence Trac, 11124 E Marshall St
Tulsa, Oklahoma 74116
Call: (918)794-8722
Email: trent@fencetrac.com
Website <https://www.fencetrac.com/>

2.4 GATE POST, VERTICAL CHANNELS, SCREWS, CAPS, BOTS, SPACER, HINGE AND LATCH

- A. Dimension: Refer to drawings.
- B. Materials: Refer to drawings
- C. Mounting: Refer to drawings
- D. Color: Black
- E. Manufacturer:
 - Fence Trac, 11124 E Marshall St
 - Tulsa, Oklahoma 74116
 - Call: (918)794-8722
 - Email: trent@fencetrac.com
 - Website <https://www.fencetrac.com/>

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Take field measurements prior to fabrication, where possible.
- B. Install site furnishings level, plumb, true, securely anchored and positioned at locations indicated on Drawings. All site furnishings shall be laid out in the field and approved prior to installation.
- C. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
- D. Restore damaged finishes and protect work.

END OF SECTION 323119

SECTION 32 84 00 – PLANTING IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Piping.
 - 2. Manual valves.
 - 3. Pressure-reducing valves.
 - 4. Automatic control valves.
 - 5. Miscellaneous piping specialties.
 - 6. Quick couplers.
 - 7. Drip irrigation specialties.
 - 8. Controllers.
 - 9. Boxes for automatic control valves.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design, calculate and test an irrigation system to suit locally available materials, project site conditions, the needs of the plants and the Architect's review. Irrigation design includes but is not limited to selecting materials and compatible jointing systems, calculating friction losses, sizing pipes and fittings and documenting location of system components.
- B. Irrigation zone control shall be automatic operation with controller and automatic control valves.
- C. Location of Irrigation Areas: Maintain 100 percent irrigation coverage of areas indicated.

1.4 SUBMITTALS

- A. Shop Drawings: Irrigation systems, drawn to scale, on which components are shown and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions such as signs and light standards.
- B. Product Data: For each type of product indicated.
- C. Qualification Data: For qualified Installer.

- D. Zoning Chart: Show each irrigation zone and its control valve.
- E. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.
- F. Field quality-control reports.
- G. Operation and Maintenance Data: For controllers and automatic control valves to include in operation and maintenance manuals.
- H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Wrenches and other tools required for maintenance of equipment.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers that include a certified irrigation designer qualified by The Irrigation Association or other registered irrigation consultant. Submit qualifications for approval by Architect.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.
- C. All drip tubing and irrigation control valves shall be suitably stored and protected until installed and placed in operation.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Architect and Owner no fewer than two (2) days in advance of proposed interruption of water service.
 - 2. Do not proceed with interruption of water service without Architect's written permission.

PART 2 - PRODUCTS

2.1 DRIP IRRIGATION COMPONENTS

- A. All drip irrigation system components shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The components shall be designed, manufactured, and installed in accordance with ASTM and AWWA methods and shall comply with these Specifications.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Rain Bird, 970 West Sierra Madre Ave., Azusa, CA 91702, Phone: (800) 724-6247, Website: www.rainbird.com.

2.2 CONVENTIONAL IRRIGATION COMPONENTS

- A. All conventional irrigation system components such as valves and sprinkler heads shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the items to be furnished. The components shall be designed, manufactured, and installed in accordance with ASTM and AWWA methods and shall comply with these Specifications.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Rain Bird, 970 West Sierra Madre Ave., Azusa, CA 91702, Phone: (800) 724-6247, Website: www.rainbird.com.

2.3 CONTROLLERS

- A. Controller Stations for Automatic Control Valves: ESP4ME3 Smart Modular Control System.
 - 1. Controller shall be equipped with weather sensing capabilities.
 - 2. Controller shall be equipped with flow sensor.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Rain Bird, 970 West Sierra Madre Ave., Azusa, CA 91702, Phone: (800) 724-6247, Website: www.rainbird.com.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section “Earth Moving.”
- B. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.

3.2 PREPARATION

- A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.

3.3 PIPING INSTALLATION

- A. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.
- B. Install piping free of sags and bends.
- C. Install groups of pipes parallel to each other, spaced to permit valve servicing.
- D. Install fittings for changes in direction and branch connections.
- E. Lay piping on solid subbase, uniformly sloped without humps or depressions.
- F. Install ductile-iron piping according to AWWA C600.
- G. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.
- H. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install above ground or in control-valve boxes.
- I. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.
- J. Install piping in sleeves under parking lots, roadways, and sidewalks.

3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- C. 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:
 - 1. Flat Latex: One coat over primer/sealer: MPI INT 9.1A.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Flanged Joints: Select rubber gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads
- E. Copper-Tubing Brazed Joints: Construct joints according to CDA's "Copper Tube Handbook," using copper-phosphorus brazing filler metal.
- F. Copper-Tubing Soldered Joints: Apply ASTM B 813 water-flushable flux to tube end unless otherwise indicated. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.
- G. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 3. PVC Nonpressure Piping: Join according to ASTM D 2855.

3.5 SPRINKLER INSTALLATION

- A. Install sprinklers after hydrostatic test is completed.
- B. Install sprinklers at manufacturer's recommended heights.
- C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches (100 mm) from walls and 2 inches (50 mm) from other boundaries unless otherwise indicated.

3.6 VALVE INSTALLATION

- A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.
- B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.
- C. Install valves and PVC pipe with restrained, gasketed joints.
- D. Aboveground Valves: Install as components of connected piping system.

- E. Throttling Valves: Install in underground piping in boxes for automatic control valves.
- F. Drain Valves: Install in underground piping in boxes for automatic control valves.

3.7 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

- A. Equipment Mounting: Install interior controllers on wall.
 - 1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
- B. Equipment Mounting: Install exterior freestanding controllers on precast concrete bases.
 - 1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Install control cable in same trench as irrigation piping and at least 2 inches below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.

3.8 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "Facility Water Distribution Piping" for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.
- C. Connect wiring between controllers and automatic control valves.

3.9 DRIP IRRIGATION

- A. Coordinate installation of zone piping and placement of dripline tubing with placement of topsoil and installation of trees, shrubs, and ground cover.
- B. Install 1 solid PVC zone piping a minimum of 12-inches below finished grade. Grade and slope shall be uniform from low point to high points with air/vacuum relief valves installed at high points within an irrigation zone.
- C. Install a flush valve and box at the end of each irrigation zone to facilitate manual flushing.
- D. Drip tubing shall be uniformly spaced at a minimum of 18-inch to provide uniform wetting at a depth of 4-6 inches below finish grade.

- E. Place air/vacuum relief valve(s) at the highest point(s) of each zone. Connect the air/vacuum relief valve to all dripline laterals within the elevated area with an air/vacuum relief lateral.
- F. Place dripline no further than four inches from the edge of the areas to be irrigated.
- G. Uniformly space drip tubing such that maximum spacing between drip tubing is 18 inches.
- H. Thoroughly flush and pressure test the drip tubing to a minimum of 10 psi prior to covering tubing to identify leaks in fittings, splices, and compression fittings. Repair all leaks.
- I. Exercise extreme care when placing plants so as not to damage or cut any drip tubing or zone piping. Repair or replace cut or damaged sections as may be warranted.
- J. Install properly sized control wiring in minimum ¾-inch PVC conduit to each control valve box for each irrigation zone. Bury conduit a minimum of 12-inches below finish grade.

3.10 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."
- B. D Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller
 - 1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Division 31 Section "Earth Moving" for warning tapes.

3.11 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Test and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Any irrigation product will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.12 STARTUP SERVICE

- A. Perform startup service.
 1. Complete installation and startup checks according to manufacturer's written instructions.
 2. Verify that controllers are installed and connected according to the Contract Documents.
 3. Verify that electrical wiring installation complies with manufacturer's submittal

3.13 ADJUSTING

- A. Adjust settings of controllers.
- B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each circuit.
- C. Adjust devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

3.14 CLEANING

- A. Flush dirt and debris from piping before installing sprinklers and other devices.

3.15 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain automatic control valves and controllers.

END OF SECTION 32 84 00

SECTION 32 92 00 – TURFGRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Sodding.
 - 2. Turf Renovation.
- B. Related Sections:
 - 1. Division 32 Section “Planting”.

1.3 DEFINITIONS

- A. Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- E. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- F. Planting Area: Areas to be planted.
- G. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.
- H. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, including soils.
 - 1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
- B. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- C. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis of standard products.
 - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turfgrass during a calendar year. Submit before start of required maintenance periods.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.
 - 1. Experience: Five (5) years' experience as a Landscape Horticulturalist as well as five (5) years experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
 - 2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 - 3. Personnel Certifications: Installer's field supervisor shall have certification as a Landscape Horticulturalist licensed by the state.
 - 4. Pesticide Applicator: State licensed, commercial.
- B. Preinstallation Conference: Conduct conference at Project site or other location approved by Architect. Contractor to notify Architect of meeting time/location at least seven (7) days in advance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, dis-charge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new turf by field measurements before proceeding with turfgrass work.
- B. Planting Restrictions: Plant during the following period. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
 1. Planting Season: May 1st to September 1st.
- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.8 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of land-scape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods.
 1. Sodded Turf: The Contractor shall maintain sodded areas for twelve (12) months from the time of Substantial Completion.

PART 2 - PRODUCTS

2.1 TURFGRASS SOD

- A. Turfgrass Sod: Approved, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod grown on sand substrate of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
- B. Turfgrass Species: Bermuda Grass (*Cynodon dactylon*): See Plans.

2.2 PESTICIDES

- A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project

conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

- B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.
 - 1. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

- A. Limit turf subgrade preparation to areas to be planted.

- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply fertilizer directly to subgrade before loosening.
 - a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
 - b. Mix lime with dry soil before mixing fertilizer.
 - 2. Spread lawn soil to a depth of 6 inches to meet finish grades after light rolling and natural settlement. Do not spread if subgrade is frozen, muddy, or excessively wet.
- C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 - 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 - 2. Loosen surface soil to a depth of at least 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
 - 3. Spread pump sand to a depth of 2 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if subgrade is frozen, muddy, or excessively wet.
 - 4. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
 - 5. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- F. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Use rolls of sod for large areas.
- C. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
3. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.
4. Sodded areas are to be top dressed using coarse sand filling seam joints.

3.5 TURF RENOVATION

- A. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
 1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
 2. Install new planting soil as required.
 3. The sod shall be of the same type and variety as the existing grass.
- B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- C. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- D. Mow, dethatch, core aerate, and rake existing turf.
- E. Water newly planted areas and keep moist until new turf is established.

3.6 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Turf Watering: Contractor shall irrigate as required to maintain vigorous and healthy turf growth. Overwatering or flooding shall not be allowed. The Contractor shall furnish any water to ensure adequate irrigation during maintenance period.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become

matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow Bermuda grass to a height of 1.0 to 2.0 inches.

- D. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.

3.7 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Landscape Architect:

1. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
2. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.8 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.9 CLEAN UP PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- C. Remove nondegradable erosion-control measures after grass establishment-period.

END OF SECTION 32 92 00

SECTION 32 93 00 – PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Plants.
 - 2. Planting Soil.
 - 3. Mulch.
 - 4. Tree Stabilization.
 - 5. Slow-Release Watering Bags.

1.3 DEFINITIONS

- A. Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- E. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- F. Planting Area: Areas to be planted.
- G. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.
- H. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 Related Documents and References

- A. Related Specification Sessions:
- B. Reference: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specification conflict with this specification section the requirements of this specification shall prevail. In the event that the requirements of any of the following referenced standards and specifications conflict with each other the more stringent requirement shall prevail or as determined by the landscape architect:
 - 1. ANSI A 300 – Standard Practices for Tree, Shrub and other Woody Plant Maintenance, most current edition and parts.
 - 2. American Standard for Nursery Stock, ANSI Z60.1., most current edition.
- C. Local Code Reference: Comply with all applicable codes, regulations, and standards enforced by the City of New Orleans, including but not limited to:
 - 1. City of New Orleans Comprehensive Zoning Ordinance
 - 2. New Orleans Parks and Parkway Specifications and Standard Detail Drawings.
 - 3. In the event of a conflict between these local requirements and the Contract Documents, the **more stringent or restrictive provision shall apply**. The Contractor shall notify the Landscape Architect of any such discrepancies prior to performing the affected work.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
 - 2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project
 - 3. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.
 - 4. Soils: Include source of materials and photographs of each constituent material.
 - 5. Mulch.
 - 6. Tree Stabilization.
 - 7. Drainage Plate
- B. Product Submittals: For the following product:
 - 1. Soil: Submit a 1-gallon sample of each soil type after mixing to architect for approval.

2. Soil Test Reports: Provide test reports from qualified independent testing agency for each soil mix:
 - a. Provide separate, clearly labeled, tests for each material and/or each source of materials if more than one for the same material.
 - b. Testing agency shall clearly indicate compliance, or lack thereof, with requirements of this specification.
 - c. Recommendations for amendments if applicable.
- C. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- D. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
 1. Manufacturer's certified analysis of standard products.
 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- E. Warranty: Written warranty and maintenance procedures.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
 2. Experience: Five years' experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 4. Pesticide Applicator, if applicable: State licensed, commercial.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1
- C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
 2. Other Plants: Measure with stems, petioles, and foliage in their normal position.
- D. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject

unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.
- E. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed. Louisiana State University Division of Agriculture Cooperative Extension Service shall be the preferred testing facility.
- F. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.
1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
 2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three (3) representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
 3. Report suitability of tested soil for plant growth.
 - a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problems materials are present, provide additional recommendations for corrective action.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.
- C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend

or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

- D. Handle planting stock by root ball.
- E. Store bulbs, rhizomes, corms, and tubers in a dry place at 60 to 65 deg F until planting.
- F. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
 - 1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - 2. Do not remove container-grown stock from containers before time of planting.
 - 3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
 - 1. Notify Architect no fewer than seven days in advance of proposed interruption of each service or utility.
 - 2. Do not proceed with interruption of services or utilities without Architect's written permission.
- C. Planting Restrictions: Plant during the following period unless temporary irrigation is installed, calibrated, operated, and maintained by the contractor for a period of 6 months from planting date.
 - 1. Planting Season: October 15 – April 1
- D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
 - 1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.9 WARRANTY

- A. Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - c. Faulty performance of tree stabilization.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Periods from Date of Substantial Completion of Project.
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
 - 3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting seasons.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at the end of warranty period.
 - c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.10 MAINTENANCE SERVICE

- A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
 - 1. Maintenance Period: The Contractor shall maintain for 12 months from the date of Substantial Completion.
- B. Initial Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.
 - 1. Maintenance Period: The Contractor shall maintain for 12 months from the date of Substantial Completion.

1.11 SUBSTITUTIONS

- A. Substitutions that do not meet the below requirements will not be considered.
- B. Preferred: Same genus. (e.g., *Rudbeckia fulgida* can be substituted with *Rudbeckia hirta*).

- C. Allowable: If same genus isn't available, use a visually and functionally similar species from the same family (e.g., substitute *Salvia nemorosa* with *Nepeta faassenii*)
- D. Size at Installation:
 - 1. Must be **equal to or larger** than specified
 - 2. Height and spread at maturity should be **comparable** (within $\pm 20\%$)
- E. Color & Form
 - 1. **Flower color**, bloom time, and foliage texture should match design intent
 - 2. **Growth habit** (upright, mounding, spreading) must be similar
- F. Environmental Compatibility
 - 1. Must be suitable for **same sun/shade, water, and soil** conditions
 - 2. **Must be non-invasive and regionally appropriate**
 - 3. **Hardiness zone** must match or be better suited
- G. Seasonal Interest
 - 1. Must maintain the same **season of bloom** or visual interest Maintenance Level
- H. Maintenance Level
 - 1. Should require **similar or less maintenance** (pruning, watering, pest control)

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 - 1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; with lichen, moss or other living substances growing on the bark; with cuts in the bark, whether healed or fresh; or with stem girdling roots will be rejected.
 - 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
 - 3. Unless approved by landscape architect, plants shall have been grown at latitude not more than 200 miles north or south of the latitude of the project.
 - 4. Plants that meet measurements but do not possess a standard relationship between height and spread, according to the American Standards for Nursery Stock, shall be rejected.
 - 5. Unless specifically noted, all plants shall be of specimen quality, exceptionally heavy, symmetrical, and so trained or favored in development and appearance as to be unquestionably and outstandingly superior in form, compactness, and symmetry.

- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

2.2 INORGANIC SOIL AMENDMENTS

- A. Add necessary inorganic soil amendments as required by the soil test.

2.3 FERTILIZERS

- A. All fertilizer shall be a commercial balanced formula with at least 25% organic material and shall conform to applicable State fertilizer laws. It shall be a slow-release formula, "Osmocote", or equal and shall be used as specified by manufacturer. Fertilizer, unless otherwise specified, shall be delivered mixed as specified, in standard size, unopened containers, showing weight, analysis and name of manufacturer.

2.4 PLANTING SOILS

- A. Planting Soil: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones one half inch ($\frac{1}{2}$ " or larger in any dimension and other extraneous materials harmful to plant growth. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes. Test soil for pH levels after mixing. Soil source to be approved in writing by Landscape Architect.
 - 1. Mix the following quantities of materials to produce Planting Soil:
 - a. 1/3 Existing Site Topsoil or Manufactured Topsoil.
 - b. 1/3 Black Bark Mulch.
 - c. 1/3 Clean Coarse Sand.
 - d. Weight of 8-8-8 Slow-Release Fertilizer per 1,000 SF: 8lbs.
 - 2. Mix the following quantities of materials to produce Lawn Soil:
 - a. 50% Existing Site Topsoil or Manufactured Topsoil.
 - b. 50% Clean Coarse Sand.

2.5 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of the following:
 - 1. Type: Pine needles in bales with long needles, not crushed or chopped.
 - 2. Depth: Three (3) inches.
 - 3. Cypress Mulch will not be accepted.
- B. Mulch must not be placed within three (3) inches of a tree trunk.

- C. The Contractor shall be responsible for the replacement of mulch during the one-year warranty and maintenance period.

2.6 TREE STABILIZATION SYSTEM

A. Tree Stabilization Above ground

1. Metal Stakes: Metal Stakes: 6' metal "T" post stakes, green. Or approved equivalent. Provide three (3) stakes per tree or as otherwise indicated in the Drawings.
2. Guying straps: ¾" wide "ArborTie" flat polypropylene strap with break strength of 900lbs (min). Color: dark green or black. As manufactured by, or approved equal
 - a. Manufacturer: Deep Root Partners, L.P., 81 Langton St., San Francisco, CA 94103, Phone: 800-458-7668, Website: www.deepproot.com or approved equal.

2.7 SLOW RELEASE WATERING BAGS

- A. Product: Treegator (Original), Slow Release Watering Bag, 20 gallons.
- B. Manufacturer: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Treegator; 153 Mosswood Blvd; Youngsville NC, 27596; Tel: (866) 873-3428, Website: www.treegator.com

PART 3 - EXECUTION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 PLANTING AREA ESTABLISHMENT

- A. Loosen subgrade of planting areas to a minimum depth of 12 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Spread planting soil to the depth as indicated per drawings to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
 - 1. Excavate approximately three times as wide as ball diameter for balled and burlapped stock.
 - 2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
 - 3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 - 4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 - 5. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 - 6. Maintain supervision of excavations during working hours.
 - 7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.

3.5 TREE, SHRUB, AND VINE PLANTING

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 2 inches above finish grades.
 - 1. Use planting soil for backfill.
 - 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - 3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
 - 4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
 - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.

3.6 TREE, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.
- B. Do not apply pruning paint to wounds.

3.7 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated in drawings in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.
- E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.8 PLANTING AREA MULCHING

- A. Mulch surfaces of planting areas and other areas indicated only to a depth of 3”.

- B. Trees without the specified depth of mulch at the end of the Warranty and Maintenance period shall be rejected.

3.9 MAINTENANCE

- A. Trees and Shrubs: Contractor shall irrigate as required to maintain vigorous and healthy plant growth. Overwatering or flooding shall not be allowed. The Contractor shall furnish any water to ensure adequate irrigation.
- B. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- C. All trees shall receive at least weekly watering though out the maintenance period.
- D. Stake Removal: At the end of the Warranty and Maintenance period, the Contractor shall be responsible for removing any above ground stakes from all trees planted under this contract.

3.10 CLEANUP PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. After installation and before Substantial Completion of Project remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.11 DISPOSAL

- A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 32 93 00

WATER UTILITIES**SECTION 331000****PART 1 - GENERAL**

- A. The Contractor shall furnish all labor, supervision, materials and equipment required for the replacement of existing water mains with new mains, including house connections, valves, manholes, hydrants, and making necessary offsets, as required.
- B. All workmanship and materials shall conform with section F of the General Specifications of the S&WB and Dwg. No. 7260-W except as noted herein.
- C. The Contractor shall notify the Chief of Network Engineering of the Sewerage & Water Board in writing a minimum of three working days and not more than ten working days in advance of starting the job
- D. All tie-ins to the existing water mains shall be made by the Contractor. The S&WB Forces shall close all valves and witnessing the tests and chlorination of the mains. Contractors shall not operate S&WB valves. Prior to making tie-ins, the Contractor shall notify residents at least 48 hours in advance of interruption of service.
- E. The existing utilities shown are approximate. The Contractor shall verify the location of utilities in the field and shall protect them from damage.
- F. Water and sewer services damaged by the Contractor shall be repaired by the S&WB at the Contractor's expense. The Contractor will be furnished a list of the locations of water and sewer house connections. This listing is from S&WB records and the listed locations could vary from the actual locations. It is the Contractor's responsibility to verify the location of these services and to protect them from damage. Furnishing this information should not be construed as a waiver of the Contractor's liability, but rather an attempt on the part of the S&WB to minimize the Contractor's hazards.

PART 2 - MATERIALS

- A. All new water mains 4-inch through 12-inch, unless otherwise noted, shall be solid wall DR 18 Polyvinyl Chloride(PVC) pipe manufactured in accordance with AWWA C900, latest edition, and shall be U.L. listed. New water mains 16-inch through 30-inch, unless otherwise noted, shall be solid wall DR 18 PVC pipe manufactured in accordance with AWWA C905, latest edition, and shall be U.L. listed. Pipe shall be furnished in standard lengths (min. 16 feet) with integral cast bells or couplings using elastomeric gaskets conforming to the AWWA C900 or AWWA C905 specification.
- B. Ductile iron pipe, unless otherwise noted, shall be Special Thickness Class 52. All ductile iron pipe shall be furnished with an asphaltic outside coating in accordance with AWWA C151 and a cement-mortar lining and seal coating, where applicable, in accordance with AWWA C104.
- C. Ductile iron fittings for water mains shall be mechanical joint restrained with external restraints such as Megalug as manufactured by EBAA Iron, Inc., or approved equal in accordance with the applicable requirements of AWWA C110 or C153 with rubber gasket joints conforming to AWWA C111. All fittings shall be furnished with an asphaltic outside coating in accordance with AWWA C151 and a cement-mortar lining and seal coating, in accordance with AWWA C104. All fittings, bends, tees, etc. shall have restrained joints in accordance with and for the length recommended by the manufacturer. All nuts, bolts and washers shall be manufactured of stainless steel conforming to the requirements of ASTM A276, Grade 316.

- D. Joint restraint devices shall be Megalug as manufactured by EBAA Iron, Inc., or approved equal. Restrained joints for pipe, valves and fittings shall be designed for a working pressure of 350 psi unless otherwise specified. Joints shall be capable of being deflected 4 degrees, after assembly.
- E. All buried ductile iron pipe and fittings shall be wrapped with 8 mils polyethylene wrap in accordance with AWWA C105. This polyethylene wrap shall cover all buried ductile iron pipe and fittings, including joints, and shall be overlapped a minimum of twelve inches between sections and sealed with black polyethylene tape.

2.2 INSTALLATION

- A. The installation of the new water main shall conform to the manufacturer's recommendations, and all the applicable requirements of Section F of the S&WB General Specifications.
- B. Bedding and backfill for water mains and all appurtenances shall be pumped Mississippi River Sand, free of roots, wood, clay lumps, or any other foreign matter and shall meet the requirements of LaDOTD Louisiana Standard Specifications for Roads and Bridges (LSSRB) Section 1003.07, latest edition.
- C. The trench bottom shall be smooth and free from roots, rocks, etc. The pipe shall be laid on a smooth bed of pumped Mississippi River sand six inches in depth for the full width of the trench and extending to the top of the pipe.
- D. Special care should be given in placing and consolidating the sand under the pipe haunches to provide adequate side support to the pipe while avoiding displacement and misalignment. The remainder of the trench shall be spread in loose lifts not to exceed twelve (12) inches and shall be compacted by mechanical vibrating equipment to at least 95 percent laboratory maximum density (dry) as determined by ASTM D 1557 at a moisture content within the limits of plus five (5) percent to minus three (3) percent of optimum. Density tests shall be one (1) per lift per one hundred (100) feet of trench. Field density in-place tests will be performed in accordance with ASTM D 2922.
- E. The Contractor shall prevent foreign material from entering the water main and contaminating it during storage and construction. The Contractor will be responsible for the cleanliness of the main at all times. At the end of each work day or stoppage of work, the Contractor must provide a temporary water tight plug at each open end. When the work is resumed, the trench must be free of water and dirt before the plug is removed.
- F. At points of tie-ins, valves, offsets and other locations where the use of ductile iron pipe is required, the Contractor shall furnish AWWA C150, Special Thickness Class 52 ductile iron pipe with rubber gasket joints. All ductile iron pipe and fittings shall have cement mortar lining in accordance with AWWA C104 and shall be wrapped with 8 mils polyethylene wrapped in accordance with AWWA C105. This tubular wrap shall cover all ductile iron pipe and fittings, including joints, and shall be overlapped a minimum of twelve inches between sections and sealed with black polyethylene tape.
- G. Offsets in water mains shall be made by the Contractor with ductile iron bends or ductile offset fittings. All ductile iron fittings and bends shall be mechanical-joint with retainer glands and shall have stainless steel nuts and bolts. Bends shall be 22.5 degree or 45 degree and no bends greater than 45 degrees are allowed unless specifically called out in the Plans.
- H. Water main offsets in the new main that are indicated on the drawings are considered main line fittings and payment is included in the price of the new water main. Water line offsets not indicated on the drawings are to be paid at the bid price for water line offsets.

2.3 LUBRICANT FOR GASKETED PIPE AND FITTINGS

- A. Lubricant shall be suitable for potable water systems and shall conform to and be certified by both of the following standards:
 - ANSI/NSF 14: Plastic Piping System Components and Related Materials
 - ANSI/NSF 61: Drinking Water System Components – Health Effects
- B. Lubricant shall be nontoxic and suitable for potable water systems, non-corrosive and be non-flammable. Lubricant shall be an emulsified polymer based product, specifically formulated to be water-soluble without causing turbidity. Lubricant shall not transfer taste and/or odor to the new water main installations. Lubricant shall not promote bacterial growth and be safe for use on all metal and plastic pipes. Lubricant shall be easily flushed from the line and be non-reactive to chlorinated water. Lubricant should work easily on both wet and dry surfaces.

The use of oleate-based lubricants is not permitted for new water main installations due to odor and taste transfer problems.

2.4 VALVES, VALVE BOXES, AND VALVE MANHOLES

- A. Valves shall be procured by the Contractor. Valves 4 in. to 12 in. shall be S&WB R.D. Wood Gate valves as shown in S&WB Dwg. 11897-W-62 or American RD Rotating Gate Disc Valve C-500 with adjustable packing. Valves 16 in. and larger shall be American RD gate valves. Valves shall have raised pattern letters "SEWERAGE & WATER BOARD" on the body of the valve. Valves must turn clockwise to open.
- B. Valves 4" to 12" shall be installed as shown on S&WB Drawing 6179-F-2.
- C. Existing valves that are replaced or no longer needed shall be removed and delivered to S&WB Central Yard, 2900 Peoples Avenue, at no direct pay.
- D. Valve Manholes for valves up to and including 12" shall be brick and installed as shown on S&WB Drawing No. 6179-F-2. Water manhole casting and covers shall conform to S&WB Drawing No. 3143-E-1.
- E. Valve Manholes for valves 16" and larger shall be as shown in the details included in the plans.
- F. Existing manholes that are replaced or no longer needed shall be abandoned in accordance with S&WB Drawing No. 8180-SD, at no direct pay.
- G. Existing manhole castings and covers that are replaced or no longer needed shall be removed and delivered to S&WB Central Yard, 2900 Peoples Avenue, at no direct pay.
- H. Valve boxes shall be installed as shown in S&WB Drawing 6179-F-2.

PART 3 - SERVICE CONNECTIONS

- A. No direct tapping of the new water main will be permitted for making house service connections. Service saddles suitable to use with PVC pipe shall be used; i.e., Clow No. 3407 (all bronze) or JCM 407 Series with 2 bolts, or J. Jones J-966 (all bronze), or approved equal. The Contractor shall use only shell type hole cutter that will retain the coupon or chips and is designed to accommodate walls equal to pressure class 200.
- B. The Contractor shall replace all existing house water connections from the new main to the meter. There shall be no splicing allowed of new or existing water service connections. Existing services shall be tied into new mains using a service saddle and corporation cock.
- C. Existing 5/8", 3/4" and 1" water house connections to be replaced shall be replaced with 1" Polyethylene (PE) tubing from the main to the meter (see S&WB Dwg. Nos. 7134-W

and 7134A-W). All other existing water house connections shall be replaced with the same size as the existing connection, unless otherwise noted

- D. All Polyethylene (PE) tubing through 2" shall be PE 3406, DR9, conforming to ASTM D2737.
- E. All Bronze/Brass fittings, connectors, corporation stops and appurtenances used in conjunction with PE tubing shall be of domestic manufacture, SHALL BE MADE OF LEAD FREE BRONZE/BRASS, and meet all requirements of AWWA, ASTM, and ANSI for use in the potable water distribution systems.
- F. Existing 4" through 8" water house connections to be replaced shall be replaced with solid wall DR 18 Polyvinyl Chloride (PVC) pipe manufactured in accordance with AWWA C900, from the main to the meter.

PART 4 - INSPECTION

- A. After the award of the Contract, the Contractor's representative, in the company of representatives of the Department of Public Works and the Sewerage & Water Board will inspect all meter boxes and list the condition of each and what corrective action is required.
- B. It is the Contractor's responsibility to schedule the meter box inspection prior to the start of construction. If no pre-construction inspection is performed, it will be assumed that all meter boxes were in good condition prior to the start of construction. Any required repairs will be at the Contractor's expense.
- C. Prior to final acceptance, all meter boxes located within the limits of this project shall be in good repair, at proper grade, properly aligned and cleaned of mud and debris. The types of repair as specified in the bid items and noted in the pre-construction inspection will be paid per each at the price bid in the proposal. The Contractor shall be paid for one bid item only for each meter box. Required repairs which were not noted at the pre-construction inspection will be assumed to be the result of the Contractor's negligence and will be repaired at his expense.
- D. All inspection of the water main and related appurtenances will be performed under the inspection of, and to the satisfaction of, the S&WB. Final acceptance of the water system is subject to a one-year maintenance period following the substantial completion date of the contract accepted by the S&WB.

PART 5 - HYDROSTATIC TESTING

- A. The Contractor shall provide and install all materials in accordance with S&WB Dwg. Nos. 7004-W and 7005-W, latest revision. The test plugs are to be caps or plugs as required and shall be secured to the pipe ends. The test plugs become the Contractor's property after their use. Prior to commencement of the hydrostatic testing, all pipes to be tested should be filled with water a minimum of twenty-four hours prior to testing in order to minimize absorption of water by the inner surface.
- B. The Contractor shall make a hydrostatic test of the main when the entire main has been laid, including service connections, valves and hydrant leads, and all apparent defects in the main, coating, joints, etc., have been repaired as described in Paragraph F-15 of the S&WB General Specifications. Testing of only a portion of the main will be done only with the approval of the S&WB. The Contractor shall provide all the equipment and all the labor required for filling and emptying the main and measuring the pressure and leakage. The Contractor's test setup shall include provisions for the Sewerage & Water

Board to install their own pressure gage so that the Contractor's pressure readings can be verified.

- C. All valves in the system shall be wide open so that pressure will come on the flanges and the test plugs which close the ends of the main and its branches, and not on the valve discs.
- D. The main shall be filled from the nearest hydrant, or from other sources of supply where hydrants are not available, to the flange outlet in the test plug. When the main is completely filled with water to the satisfaction of the Director, the Contractor shall close the air cocks. He shall apply a hydrostatic pressure of 100 psi on the water main system, including fire hydrants, fire hydrant leads, valves, and service connections and shall maintain this pressure for a minimum period of (2) two hours with no pressure loss.
- E. If leakage develops, the Contractor shall locate the leaks and repair them, working only from outside the main and using only such methods as approved in advance by the S&WB's Engineer.
- F. It is the intent of these specifications and of the contract based thereon, that all pipe joints be water tight under all service conditions. Any and all leaks from improperly laid or defective joints which are discovered during the leakage test or tests, or at any time prior to the elapse of one year following the final acceptance by the S&WB of the entire work, will be repaired by and at the expense of the Contractor.
- G. Hydrostatic testing shall be performed by the Contractor under the direct supervision of and to the satisfaction of the S&WB Engineer, at no direct pay.

5.2 CHLORINATION

- A. The Contractor shall not proceed with the chlorination process until successfully passing the hydrostatic pressure test and given authorization to proceed by the S&WB Engineer.
- B. The Contractor shall use the continuous feed method of chlorination as described in AWWA Standard C651. The tablet method and the slug method are not acceptable.
- C. The Contractor shall use either sodium hypochlorite or calcium hypochlorite to provide the disinfectant for the chlorination process. If calcium hypochlorite is used, the Contractor shall pre-mix the calcium hypochlorite into solution before application. All hypochlorite raw materials must be certified as suitable for the treatment of drinking water by an accredited certification organization in accordance with ANSI/NSF Standard 60, Drinking Water Treatment Chemicals – Health Effects.
- D. The Contractor shall flush the mains prior to the chlorination. Flushing shall be done at flow rates sufficient to provide a velocity in the water main of at least 2.5 feet per second to remove particulate debris prior to disinfection. During this flushing process, the Contractor shall make sure there are no air pockets present within the system.
- E. The Contractor shall follow AWWA Standard C651, latest revision, these Special Specifications and shall meet the requirements of the Louisiana Department of Health and Hospitals (LA-DHH) for installation and disinfection of potable water mains. Transporting, storage, and handling of all disinfection products, utilized for chlorination, shall be performed in accordance with all applicable Federal, State, Local Laws and Regulations.
- F. The Contractor shall chlorinate the new water main system, including fire hydrants, fire hydrant leads, valves, and service connections, under the direct supervision of the S&WB, such that the minimum chlorine concentration throughout the system is 50 mg/l. The chlorinated water shall be retained in the pipe for 24 hours for water mains less than

30 inches in diameter, and for 48 hours for water mains greater than or equal to 30 inches in diameter. After the required retention time, the chlorinated residual shall be at least 5 mg/l free chlorine, as measured by the S&WB. If the residual is less than 5 mg/l at any point in the system, the initial flushing and disinfection procedure shall be repeated by the Contractor until a 5 mg/l free chlorine residual is obtained. The Contractor shall contact the S&WB Water Purification Department (504) 865-0572, a minimum of 48 hours prior to chlorinating the new main to schedule the sample collection.

- G. The maximum length of water piping that can be chlorinated at one time is 2,000 (two thousand) linear feet.
- H. The Contractor shall flush the chlorinated water from the new main using potable water. Disposal of chlorinated water shall be in accordance with AWWA Standard C651 and all federal, state, and local requirements. The Contractor's chlorination and flushing setup shall include provisions for the S&WB to collect a sample, via a ¾" faucet without hose bib threads, on the inlet and each discharge stand pipe.
- I. The S&WB shall collect and analyze samples for coliform bacteria, chlorine residual, and turbidity from all pipe extremities and from representative points. All samples must be free from contamination by coliform bacteria and have acceptable turbidity levels as determined by the S&WB. The Contractor shall be responsible for final flushing and coordinating sample collection by the S&WB.
- J. Chlorination and flushing of water mains shall be performed by the Contractor, at no direct pay. Also, no additional payment will be allowed for providing taps for chlorine injection and/or flushing if necessary.
- K. In the event that a new water main tests positive for coliform bacteria following chlorination, the Contractor will be responsible for reflushing the main and coordinating resampling for coliform analysis. If the second set of coliform samples test positive, the Contractor shall be required to repeat the chlorination procedure. A fee may be imposed on the Contractor for the additional supervision, sampling, and analysis required of S&WB employees as the result of the necessity of resampling and/or re-chlorination.

5.3 TIE-INS

- A. The Contractor shall tie-in the new water main within 72 hours of receiving notification of acceptable laboratory test results from the S&WB. If the Contractor fails to complete the tie-in within 72 hours, additional flushing and re-testing for coliform bacteria by S&WB shall be required. Under no circumstances will the Contractor be allowed to make a tie-in to the existing water distribution system until acceptable laboratory test results have been obtained by the S&WB. All tie-ins shall be performed under the direct supervision, and to the satisfaction, of the S&WB. A fee may be imposed on the Contractor for the additional supervision, sampling, and analysis required of S&WB employees as a result of the necessity of resampling and/or re-chlorination.
- B. The tie-in shall be configured in such a manner to require 16 linear feet of pipe or less. The S&WB does not allow installation of pipe runs greater than 16 linear feet without hydrostatic pressure testing and chlorination. All pipe used in the tie-in shall be thoroughly cleaned and swabbed with a 1-5 percent hypochlorite disinfecting solution just prior to being installed, as recommended by AWWA C651.
- C. The S&WB forces shall be responsible for the closure of all water valves. Contractors shall not operate S&WB valves. The S&WB cannot guarantee a water-tight closure. The Contractor must work continuously and without interruption until the new piping is tied into the existing system and services are restored.

- D. Before the water service is interrupted, the Contractor shall:
 - 1. Expose the existing water main at the tie-in location and verify the type, size, location, and elevation of the existing facilities.
 - 2. Have sufficient materials, equipment and manpower available at the job site.
 - 3. Verify materials on hand will meet the job needs after uncovering the existing mains.
 - 4. Request a water test closure through the S&WB Networks Department (942-3891) a minimum of seven (7) working days in advance of the scheduled tie-ins.
 - 5. Have notified all residents and the New Orleans Fire Department a minimum of forty-eight (48) hours in advance of interruption of service.
- E. After the tie-in is completed, the new line will be refilled under normal S&WB water main pressure (approximately 60 pounds per square inch). Tie-in piping will then be visually inspected for leaks and if any leaks are discovered shall be repaired by the Contractor using only such methods as approved by the S&WB, at the Contractors expense.
- F. The Contractor shall perform a final flush on the newly installed water main under the supervision of the S&WB Engineer to flush out the remaining free chlorine residual and fill the line with water representative of the quality in the distribution system prior to hydraulically connecting the new main to the distribution system
- G. All tie-ins shall be made by the Contractor, at no direct pay.

END OF SECTION

STORM DRAINAGE PIPING AND STRUCTURES

SECTION 334100

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Nonpressure transition couplings.
 - 3. Cleanouts.
 - 4. Drains.
 - 5. Manholes.
 - 6. Catch basins.
 - 7. Pipe outlets.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.
- D. Handle **catch basins** according to manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, **T-1** wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.2 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
 1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
- C. Unshielded, Flexible Couplings:
 1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.3 CLEANOUTS

- A. Plastic Cleanouts:
 1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.4 DRAINS

- A. Cast-Iron Area Drains:
 1. Description: ASME A112.6.3 gray-iron round body with anchor flange and round grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
 2. Top-Loading Classification(s): **Medium and Heavy Duty**

2.5 MANHOLES

- A. Standard Precast Concrete Manholes:
 1. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
 3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.

4. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch (102-mm) minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
9. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (102-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "DRAIN."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

C. Supports, Anchors, and Setting Devices: Manufacturer's standard unless otherwise indicated.

2.6 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 4-inch (102-mm) minimum thickness, 48-inch (1200-mm) diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch (150- to 225-mm) total thickness, that match 24-inch- (610-mm-) diameter frame and grate.
8. Steps: wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches (1500 mm).

9. Pipe Connectors: ASTM C 923 (ASTM C 923M), resilient, of size required, for each pipe connecting to base section.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Sections 312323 and 312333.

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install cleanouts for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, nonpressure drainage piping according to the following:
 1. Install piping pitched down in direction of flow.
 2. Install piping with 12-inch minimum cover.
 3. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
 1. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.

3.4 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 1. Use Light-Duty, top-loading classification cleanouts in **earth or unpaved foot-traffic**.
 2. Use Medium-Duty, top-loading classification cleanouts in **paved foot-traffic**.
 3. Use Heavy-Duty, top-loading classification cleanouts in **vehicle-traffic service**.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, **18 by 18 by 12 inches (450 by 450 by 300 mm)** deep. Set with tops **1 inch (25 mm)** above surrounding earth grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.5 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
 1. Use Light-Duty, top-loading classification drains in **earth or unpaved foot-traffic** areas.
 2. Use Medium-Duty, top-loading classification drains in **paved foot-traffic** areas.
 3. Use Heavy-Duty, top-loading classification drains in **vehicle-traffic service** areas.
- B. Embed drains in 4-inch (102-mm) minimum concrete around bottom and sides.
- C. Set drain frames and covers with tops flush with pavement surface.

3.6 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements.

3.7 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.

- B. Set frames and grates to elevations indicated.

3.8 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct riprap of broken stone, as indicated.
- B. Install outlets that spill onto grade, anchored with concrete, where indicated.
- C. Construct energy dissipaters at outlets, as indicated.

3.9 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.10 CONNECTIONS

- A. Make connections to existing piping and underground manholes.
 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
 2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
 3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.
 - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.11 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.
 1. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 3. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 3. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
 - b. Option: Test plastic piping according to ASTM F 1417.
- C. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. **Flush with water.**

END OF SECTION