

ENVIRONMENTAL COMPLIANCE CENTER EDUCATIONAL BUILDING

1327 West Dan Ronquillo Drive
Fresno, CA 93706

Contract # 24-S-01

The County of Fresno
Department of Public Works and Planning
2220 Tulare St., 8th Floor
Fresno, California 93721

PROJECT MANUAL

Pre-bid Conference: Wednesday, August 14, 2024, 10:00 A.M.

Bid Date: Thursday, August 29, 2024
2:00 P.M. (1400 hours and 00 seconds)

Budget / Account – 9015 / 8150 / 91440



Development Services & Capital Projects Division

Department of Public Works and Planning

CONTRACT # 24-S-01

SECTION 000002 - PROJECT AUTHORITY PAGE

ENVIRONMENTAL COMPLIANCE CENTER EDUCATIONAL BUILDING

Contract # 24-S-01

| | |
|-----------------------------|--------------------------|
| Nathan Magsig, Chairman | 5 th District |
| Buddy Mendes, Vice Chairman | 4 th District |
| Brian Pacheco | 1 st District |
| Steve Brandau | 2 nd District |
| Sal Quintero | 3 rd District |

Paul Nerland, County Administrative Officer

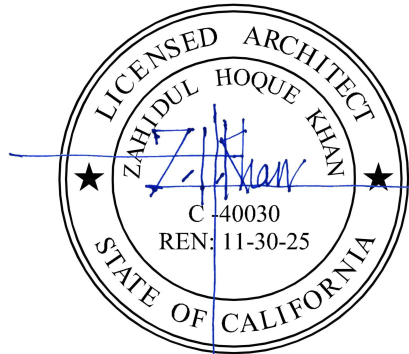


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Civil Engineer

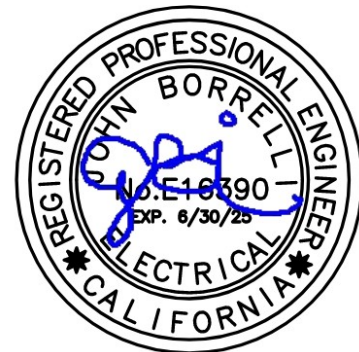
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SECTION 000003 - TABLE OF CONTENTS

DIVISION 0 – PROCUREMENT AND CONTRACTING REQUIREMENTS

| | |
|----------|---------------------------|
| 00 00 01 | Cover Page |
| 00 00 02 | Project Authority Page |
| 00 00 03 | Table of Contents |
| 00 00 04 | Drawing Sheet Index |
| 00 11 13 | Notice to Bidders |
| 00 21 13 | Instruction to Bidders |
| 00 22 13 | Bidder's Checklist |
| 00 42 13 | Proposal Form |
| 00 43 13 | Bid Security Form |
| 00 43 36 | Subcontractor's List |
| 00 45 19 | Non-Collusion Declaration |
| 00 52 13 | Agreement |
| 00 65 36 | Guaranty |
| 00 72 00 | General Conditions |

DIVISION 1 – GENERAL REQUIREMENTS

| | |
|----------|-----------------------------------|
| 01 50 00 | Temporary Facilities and Controls |
| 01 33 23 | Submittal Procedures |
| 01 77 19 | Project Closeout |
| 01 78 36 | Warranties and Bonds |

DIVISION 2 – EXISTING CONDITIONS

| | |
|----------|------------------------|
| 02 01 00 | Subsurface Exploration |
|----------|------------------------|

DIVISION 3 – CONCRETE

| | |
|----------|----------------------------------|
| 03 10 00 | Concrete Forming and Accessories |
| 03 20 00 | Concrete Reinforcing |
| 03 30 00 | Cast-In-Place Concrete |
| 03 35 43 | Polished Concrete Finishing |
| 03 39 00 | Concrete Curing |

DIVISION 5 – METALS

- 05 12 00 Structural Steel Framing
- 05 40 00 Cold-Formed Metal Framing
- 05 50 00 Metal Fabrications

DIVISION 6 – WOOD AND PLASTICS

- 06 19 00 Miscellaneous Carpentry
- 06 40 00 Architectural Woodwork

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

- 07 11 13 Bituminous Dampproofing
- 07 13 13 Self-Adhering Sheet Waterproofing
- 07 21 00 Building Insulation
- 07 25 00 Concrete Slab Vapor Emissions Treatment
- 07 41 13 Insulated Metal Roof Panels
- 07 42 13 Insulated Metal Wall Panels
- 07 42 93 Soffit and Liner Panels
- 07 05 00 Modified Bituminous Membrane Roofing
- 07 62 00 Sheet Metal Flashing and Trim
- 07 92 00 Joint Sealants

DIVISION 8 – DOORS AND WINDOWS

- 08 11 13 Hollow Metal Doors, Windows, and Frames
- 08 31 13 Access Doors and Frames
- 08 41 13 Aluminum Framed Entrances and Storefronts
- 08 71 00 Door Hardware
- 08 80 00 Glazing

DIVISION 9 – FINISHES

- 09 29 00 Gypsum Board
- 09 30 00 Ceramic Tile

| | |
|----------|-------------------------------------|
| 09 51 13 | Acoustical Panel Suspended Ceilings |
| 09 65 13 | Resilient Wall Base and Accessories |
| 09 91 00 | Painting |

DIVISION 10 – SPECIALTIES

| | |
|----------|---------------------------------|
| 10 14 00 | Signage |
| 10 26 23 | Decorative Protection Panels |
| 10 28 00 | Toilet Room Accessories |
| 10 44 13 | Fire Extinguishers and Cabinets |

DIVISION 13 – SPECIAL CONSTRUCTION

| | |
|----------|------------------------|
| 13 34 19 | Metal Building Systems |
|----------|------------------------|

DIVISION 20 – MECHANICAL

| | |
|----------|-------------------------------|
| 20 01 00 | General Mechanical Provisions |
|----------|-------------------------------|

DIVISION 21 – FIRE SUPPRESSION

| | |
|----------|-----------------------|
| 21 00 00 | Fire Sprinkler System |
|----------|-----------------------|

DIVISION 22 – PLUMBING

| | |
|----------|----------|
| 22 04 00 | Plumbing |
|----------|----------|

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING

| | |
|----------|---|
| 23 08 00 | Heating, Ventilating and Air Conditioning |
|----------|---|

DIVISION 25 – INTEGRATED AUTOMATION

| | |
|----------|-------------------------------|
| 25 09 00 | Direct Digital Control System |
|----------|-------------------------------|

DIVISION 26 – ELECTRICAL

| | |
|----------|--|
| 26 00 00 | General Electrical Requirements |
| 26 05 00 | Basic Electrical Materials and Methods |
| 26 05 26 | Grounding |

| | |
|----------|---|
| 26 05 29 | Hangers and Supports for Electrical Systems |
| 26 05 48 | Vibration and Seismic Controls for Electrical Systems |
| 26 08 00 | Commissioning of Electrical Systems |
| 26 24 16 | Panelboards |
| 26 27 00 | Low Voltage (0-600V) Distribution Equipment |
| 26 28 00 | Low Voltage (0-600V) Circuit Protective Devices |
| 26 50 00 | Lighting |

DIVISION 27 – COMMUNICATIONS

| | |
|----------|--|
| 27 11 00 | Communications Equipment Room Fittings |
| 27 15 00 | Communications Horizontal Cabling (Cat6) |

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

| | |
|----------|--------------------------|
| 28 31 00 | Fire Detection and Alarm |
|----------|--------------------------|

DIVISION 31 – EARTHWORK

| | |
|----------|--------------------|
| 31 05 13 | Soil for Earthwork |
| 31 22 00 | Grading |

DIVISION 32 – EXTERIOR IMPROVEMENTS

| | |
|----------|--------------------------------|
| 32 17 23 | Paint and Marking Site Surface |
|----------|--------------------------------|

DIVISION 33 – UTILITIES

| | |
|----------|---------------------------|
| 33 10 00 | Water Utilities |
| 33 30 00 | Sanitary Sewage Utilities |
| 33 40 00 | Storm Drainage Utilities |
| 33 49 20 | Storm Drainage Drywells |

END OF SECTION

SECTION 000004 - DRAWING SHEET INDEX

ENVIRONMENTAL COMPLIANCE CENTER EDUCATIONAL BUILDING

- G-1.0 Cover Page
- G-1.1 Code Analysis
- G-1.2 California Green Building Standards Codes

Architectural Sheets

- A-1.0 Site Plan
- A-2.0 Dimension Floor Plan
- A-2.1 Noted Floor Plan
- A-2.2 Restroom Enlarged Floor Plan and Interior Elevations
- A-2.3 Concrete Slab / Walk Control Joint Plan
- A-3.0 Reflected Ceiling Plan
- A-4.0 Roof Plan
- A-5.0 Exterior Elevations
- A-6.0 Interior Elevations
- A-6.1 Interior Elevations
- A-7.0 Building Sections
- A-8.0 Opening Schedules
- A-8.1 Finish Schedules
- A-8.2 Site Details
- A-8.3 Accessible Details
- A-8.4 Signage Details
- A-8.5 Interior Details
- A-8.6 Interior Details
- A-8.7 Opening Details
- A-8.8 Exterior Details
- A-8.9 Roof Details
- A-8.10 Exterior Details

Civil Sheets

| | |
|------|-------------------|
| C1.0 | Civil Cover Sheet |
| C2.0 | Notes Sheet |
| C3.0 | Grading Plan |
| C4.0 | Utility Plan |
| C5.0 | Details |

Structural Sheets

| | |
|-------|----------------------------|
| S1.00 | Typical Structural Notes |
| S1.01 | Typical Structural Notes |
| S1.02 | Typical Framing Details |
| S1.03 | Typical Framing Details |
| S1.04 | Typical Structural Details |
| S1.05 | Typical Structural Details |
| S2.0 | Foundation Plan |
| S3.0 | Foundation Details |
| S4.0 | Roof Framing Plan |
| S4.1 | Ceiling Framing Plan |
| S5.0 | Details |
| S6.0 | Details |
| S7.0 | Monument Sign Details |

Plumbing Sheets

| | |
|-------|---------------------------------|
| P-0.1 | Plumbing Legend and Schedules |
| P-0.2 | Plumbing Calculations and Notes |
| P-1.0 | Plumbing Site Plan |
| P-2.0 | Plumbing Floor Plan |
| P-3.0 | Plumbing Roof Plan |
| P-4.0 | Plumbing Details |
| P-4.1 | Plumbing Details |
| P-4.2 | Plumbing Details |

Mechanical Sheets

| | |
|-------|-----------------------------------|
| M-1.0 | HVAC Notes, Legend, and Schedules |
| M-2.0 | HVAC Floor Plan - Duct |

| | |
|-------|------------------------------|
| M-2.1 | HVAC Floor Plan – VRF Piping |
| M-2.2 | HVAC – VRF Diagrams |
| M-3.0 | HVAC Details |
| M-4.0 | HVAC Title 24 |
| M-4.1 | HVAC Title 24 |
| M-4.2 | HVAC Title 24 |

Electrical Sheets

| | |
|-------|--|
| E1.01 | Sheet Index, Symbol List, Abbreviations, and Notes |
| E1.02 | Additional Notes and Requirements |
| E1.03 | Single Line Diagram |
| E1.04 | Data and Intrusion Alarm Riser Diagram, Panel and Weight & Dimension Schedules |
| E1.05 | Light Fixture Schedule |
| E2.01 | Electrical and Fire Alarm Site Plan |
| E2.02 | Partial Photometrics Site Plan |
| E3.01 | Electrical Power and Signal Floor Plan |
| E3.02 | Lighting Floor Plan |
| E3.03 | Emergency Photometrics Floor Plan |
| E3.04 | Electrical Roof Plan |
| E4.01 | Fire Alarm Riser Diagram, Notes and Calculations – For Reference Only |
| E4.02 | Fire Alarm Floor Plan – For Reference Only |
| E5.01 | Typical Electrical Details |
| E5.02 | Typical Electrical Details |
| E5.03 | Typical Electrical Details |
| E5.04 | Solar System Data Sheets |
| E5.05 | Solar System Data Sheets |
| E5.06 | Not Used |
| E5.07 | Battery Energy Storage System Data Sheets |
| E6.01 | Power Title 24 |
| E6.02 | Power Title 24 |
| E6.03 | Outdoor Lighting Title 24 |
| E6.04 | Outdoor Lighting Title 24 |
| E6.05 | Outdoor Lighting Title 24 |
| E6.06 | Indoor Lighting Title 24 |
| E6.07 | Indoor Lighting Title 24 |
| E6.08 | Indoor Lighting Title 24 |

| | |
|-------|----------------------------|
| E6.09 | Not Used |
| E6.10 | Not Used |
| E6.11 | Solar and Battery Title 24 |
| E6.12 | Solar and Battery Title 24 |
| E7.01 | Typical Solar Details |
| E7.02 | Typical Solar Details |
| E7.03 | Typical Solar Details |
| E7.04 | Typical Solar Details |

Fire Sheets

| | |
|-------|---------------------------|
| F-1.0 | Fire Protection Site Plan |
| F-2.0 | Fire Protection Plan |
| F-2.1 | Section Drawings |
| F-3.0 | Riser and Piping Details |
| F-3.1 | Installation Details |
| F-3.2 | Site Fire Details |
| F-3.3 | Structural Details |

TOTAL: 99 Sheets

END OF SECTION

BOARD OF SUPERVISORS COUNTY OF FRESNO STATE OF CALIFORNIA
NOTICE TO BIDDERS

Sealed proposals will be received at:

<https://www.bidexpress.com/businesses/36473/home>

and at the Fresno County Department of Public Works and Planning, Office of the Design Engineer, Seventh Floor, Fresno County Plaza Building, 2220 Tulare Street, Fresno, CA 93721 until

2:00 P.M., (1400 hours and 00 seconds)
Thursday, August 29, 2024

at which time the bidding will be closed.

If you have any questions about bid submission, please contact us at DesignServices@fresnocountyca.gov or call (559) 600-4543.

Promptly following the closing of the bidding all timely submitted bids will be publicly opened and viewable via a livestream (the link for which will be posted at <http://www.fresnocountyca.gov/planholders>) for construction in accordance with the project specifications therefor, to which special reference is made as follows:

**ENVIRONMENTAL COMPLIANCE CENTER
EDUCATIONAL BUILDING**

**1327 WEST DAN RONQUILLO DRIVE
FRESNO, CA 93706**

Contract No. 24-S-01

The work to be done consists, in general, of the construction of a single-story building constructed with pre-engineered metal structures and fenestrated with insulated metal panels and pre-finished aluminum doors and glazings. Covering approximately 3,000 square feet, it will offer space for various functions such as an education room, a general office, an executive office, a break room, two unisex restrooms, a storage and janitor room, and a hallway with drinking fountains. The site will provide six parking stalls, two of which will be accessible, along with an accessible pathway leading to an existing on-site bus stop.

A pre-bid conference will be held at 10:00 a.m., on Wednesday, August 14, 2024. A discussion of the project will be held and the project sites will be open for examination. Contractors should meet at 1327 West Dan Ronquillo Drive, Fresno, CA 93706.

Attendance at the pre-bid is **mandatory** for general contractors; attendance by subcontractors is encouraged, but not required. The scheduled pre-bid will be the only opportunity for prospective bidders to visit the site in the presence of County staff, and requests for individual site visits with County staff will not be granted.

This project is subject to the contracting requirements and implementing regulations as amended in Title 13, Section 2449 General Requirements for In-Use Off-Road Diesel-Fueled Fleets, of the California Code of Regulations (13 CCR § 2449(i)). Bidders must submit a valid Certificate of Reported Compliance (CRC) issued by the California Air Resources Control Board at the time of bidding. Bidders are responsible for submitting their listed subcontractors' CRCs and any supporting documentation within five (5) calendar days of bid opening. Failure to submit the required CRCs may render a bid non-responsive.

Bidders may fill out a Request to be Added to Planholders list:

<https://www.fresnocountyca.gov/Departments/Public-Works-and-Planning/Construction-Bidding-Opportunities/Request-to-Be-Added-to-the-Planholders-List-Form>

Requesters will then be listed as a planholder for the project on the website and receive notifications and addenda issued for the project.

Prospective bidders may also select the project on <https://www.bidexpress.com/businesses/36473/home>. Those that demonstrate interest in the project will be added to the planholders list, and receive notifications and addenda issued for the project.

Electronic copies, in “.pdf” file format, of the official project plans and specifications, bid books and proposal sheets, as well as cross sections and such additional supplemental project information as may be provided, are available to view, download, and print at <http://www.fresnocountyca.gov/planholders>.

If a bidder is unable to submit a bid via Bid Express, Bid Books, which contain bid proposal sheets necessary to submit a bid, may be obtained within the Specifications documents posted on the Fresno County website.

Electronic bids shall be submitted via the Bid Express website. Hardcopy bids shall be submitted in a sealed envelope addressed to the Department and labeled with the name of the bidder, contract number, name of the project, and the statement “Do Not Open Until the Time of Bid Opening.”

Bid security in the amount of ten (10) percent of the amount of the bid, and in the form of a bid bond issued by an admitted surety insurer licensed by the California Department of Insurance, cash, cashier's check or certified check shall accompany the bid. You must either attach an electronic bid bond or provide an original bid bond (or other form of bid security authorized by Public Contract Code section 20129(a)), prior to the bid opening. Bid security shall be made in favor of the County of Fresno.

Hardcopy bid bonds shall be submitted in a sealed envelope addressed to the Department and labeled with the name of the bidder, the name of the project and the statement “Do Not Open Until the Time of Bid Opening – BID BOND”

A Summary of Bids and a list of subcontractors for the apparent low bidder will be posted at the above listed website, generally within 24 hours of the Bid Opening.

The apparent lowest bidder shall submit a Cost Distribution of the bid, otherwise known as a “Schedule of Values,” (refer to Section 002113 Instructions to Bidders 1.16 Post-Bid / Pre-Award Information and Requirements) within eight (8) days of the Bid Opening.

All requests for substitutions (refer to Section 012500, Substitution Procedures) and questions regarding this project shall be in writing and shall be received by the Department of Public Works and Planning, Design Division, no later than 2:00 P.M. on the tenth (10th) calendar day prior to bid opening. All substitution requests and questions received after this deadline will not receive a response unless the Department of Public Works and Planning elects to issue an addendum to revise the bid opening date. In the event that the bid opening date is revised, the deadline for questions will be extended to no later than 2:00 P.M. on the tenth (10th) calendar day before the revised bid opening date. Questions shall be submitted on the “Request for Clarification” form provided on the project website at:

<https://www.fresnocountyca.gov/Departments/Public-Works-and-Planning/Construction-Bidding-Opportunities/24-S-01-Environmental-Compliance-Center-Educational-Building/Request-for-Clarification-Form>

Any changes to, or clarification of, the Contract documents and specifications, including approved substitutions, shall be in the form of a written addendum issued to planholders of record. Questions that prompt a change or clarification shall be included in the addendum with the subsequent answer.

Any oral explanation or interpretations provided with regard to this project are not binding.

No contract will be awarded to a contractor who has not been licensed in accordance with the provisions of the Contractors State License Law, California Business and Professions Code, Division 3, Chapter 9, as amended, or whose bid is not on the proposal form included in the contract document. A valid California Contractor's License, **Class B (General Building Contractor)**, is required for this project.

Asbestos certification from the Contractors State License Board and registration with the Division of Occupational Safety and Health is not required to bid this project. [Health and Safety Code 25914.2] The Contractor and their subcontractors shall comply with all applicable statutes and regulations, and all provisions of Sections 2.51, 2.52 and 2.55 of the General Conditions, regarding payment of wages, hours of work and all other labor compliance issues.

Pursuant to Section 1773 of the Labor Code, the general prevailing wage rates in the county, or counties, in which the work is to be done have been determined by the Director

of the California Department of Industrial Relations. These wages are set forth in the General Prevailing Wage Rates for this project, available at County of Fresno, Department of Public Works and Planning, 2220 Tulare Street, Sixth Floor, Fresno CA 93721-2104 and available from the California Department of Industrial Relations' Internet web site at <http://www.dir.ca.gov/DLSR/PWD>. Future effective general prevailing wage rates, which have been predetermined and are on file with the California Department of Industrial Relations are referenced but not printed in the general prevailing wage rates.

This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations.

No contractor or subcontractor may be listed on a bid proposal for a public works project unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5 [with limited exceptions from this requirement for bid purposes only under Labor Code section 1771.1(a)].

No contractor or subcontractor may be awarded a contract for public work on a public works project unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5.

This contract is subject to state contract nondiscrimination and compliance requirements pursuant to Government Code, Section 12990.

The Board of Supervisors hereby specifies that portions of the work can only be performed outside the regular working hours as defined in the applicable collective bargaining agreement filed with the Director of Industrial Relations in accordance with Labor Code Section 1773.1, and that the overtime requirements for Saturdays, and holidays are hereby waived for these portions of the work, as more particularly described in the specifications. However, this exemption shall not negate the overtime provisions specified in Labor Code Section 1815.

Bids are required for the entire work described herein. Bids will be compared on the basis of the total lump sum bid.

In addition to the bid bond required by law of all bidders on public works projects, the successful bidder shall furnish a faithful performance bond, a payment bond and a warranty bond in accordance with the provisions of Section 2.36 of the General Conditions.

The successful bidder shall furnish a faithful performance bond in the amount of 100 percent of the contract amount and a payment bond in the amount of 100 percent of the contract amount. Each bond specified in this Notice (bid bond, faithful performance bond and payment bond) shall meet the requirements of all applicable statutes, including but not limited to those specified in Public Contract Code section 20129 and Civil Code section 3248.

Each bond specified in this Notice shall be issued by a surety company designated as an admitted surety insurer in good standing with and authorized to transact business in this

state by the California Department of Insurance, and acceptable to the County of Fresno. Bidders are cautioned that representations made by surety companies will be verified with the California Department of Insurance. Additionally, the County of Fresno, in its discretion, when determining the sufficiency of a proposed surety company, may require the surety company to provide additional information supported by documentation. The County generally requires such information and documentation whenever the proposed surety company has either a Best's Key Rating Guide of less than **A** and a financial size designation of less than **VIII**. Provided, however, that the County expressly reserves its right to require all information and documentation to which the County is legally entitled from any proposed surety company.

Pursuant to Public Contract Code Section 22300, substitution of securities for any moneys withheld by the County of Fresno to ensure performance under the contract shall be permitted.

The Board of Supervisors reserves the right to reject any or all bids.

Board of Supervisors, County of Fresno

Paul Nerland, County Administrative Officer

Bernice E. Seidel, Clerk to the Board

Issue Date: July 30, 2024

INSTRUCTIONS TO BIDDERS

1.01 EXPLANATION TO BIDDERS

An explanation desired by bidders regarding the meaning or interpretation of the bid documents must be requested in writing no later than 10 days prior to the bid opening.

Oral explanations given before the award of the contract will not be binding. Any interpretation made will be in the form of an addendum to the bid documents, said addendum will only be issued by the County's Director of Public Works and Planning ("Director"). Any addenda or supplemental information will be published on the Fresno County website at <https://www.fresnocountyca.gov/planholders> and the planholders of record will be notified.

1.02 EXAMINATION OF PLANS, SPECIFICATIONS, SPECIAL PROVISIONS AND SITE OF WORK

The bidder is required to examine carefully the proposal, plans, specifications, special provisions, and contract forms for submitting a proposal. It is mutually agreed that the submission of a proposal shall be considered prima facie evidence that the bidder has made such examination and is satisfied with the conditions to be encountered in performing the work and as to the requirements of the plans, specifications, and special provisions of the contract documents.

1.03 PROPOSAL GUARANTEE

The bidder shall furnish a proposal guarantee, consisting of a bid bond, cash, certified check, or cashier's check, for ten percent (10%) of the total amount bid, including additives.

If security is provided in the form of a certified check or cashier's check, the County may make such disposition of same as will accomplish the purpose for which submitted. Checks deposited by unsuccessful bidders will be returned as soon as practicable after the bid opening.

1.04 PREPARATION OF PROPOSALS

The bidder shall prepare a proposal on the blank proposal form furnished by the County.

The bidder's proposal shall be executed by the individual, by one or more partners of the partnership, or by one or more of the officers of the corporation submitting it. If the proposal is made by an individual, a name and post office address must be shown. If made by a partnership, the name of each member of the partnership must be shown. If made by a corporation, the proposal must show the name of the state under which the corporation was chartered and the name of the president, vice president, secretary and treasurer.

1.05 SUBCONTRACTORS

Every person submitting a bid to perform the work called for in the bid request shall set forth in this bid:

- A. The name and the location of the place of business, and the California contractor's license number, and the public works contractor registration number issued pursuant to Section 1725.5 of the Labor Code, of each subcontractor who will perform work or labor or render service to the general contractor in or about the construction of the work or improvement in an amount in excess of one-half (1/2) of one percent (1%) of the general contractor's total bid; and
- B. The portion of the work which will be done by each subcontractor.

The attention of bidders is directed to the provisions of Public Contract Code Section 4100 et seq which set forth the consequences and possible penalties which may result from a failure to comply strictly with the foregoing requirements for listing of subcontractors.

1.06 SUBMISSION OF PROPOSAL

A. Electronic Bid Submittal

The bidder has the option to submit the bid for this Project electronically. The bidder must either attach an electronic bid bond or provide an original bid bond (or other form of bid security authorized by Public Contract Code Section 20129(a)), prior to the bid opening.

Bidders submitting online may use one of the accepted electronic sureties (Tinubu Surety or Surety 2000) to submit their bid bond; or may submit cash, cashier's check, certified check, or a bidder bond to Design Services at 2220 Tulare St., Seventh Floor, Fresno, CA 93721. Those submitting bid bonds directly to Design Services must submit their bid bond:

1. Under sealed cover
2. Marked as a bid-bond
3. Identifying the contract number and the bid opening date on the cover

If necessary, please e-mail DesignServices@fresnocountyca.gov or call (559) 600-4241 or (559) 600-4543, so that arrangements may be made to hand deliver your bid bond.

Each proposal shall be submitted in a sealed envelope labeled to clearly indicate the contract and contents.

B. Bid Submittal by Personal Delivery or by Mail

The bidder has the option to submit the bid by personal delivery or by mail. The bidder shall specify, on the blank Proposal form, a lump sum price in both words and figures for each bid item, including alternates, additives and supplemental items. If the bid is not submitted electronically, then all words and figures shall be written on the Proposal form in ink. In the case of a discrepancy between the prices written in words and those written in figures,

the written words shall govern. The bidder's proposal shall be signed in ink by the individual executing the bid on behalf of the bidder.

The required proposal guarantee must accompany the proposal.

When sent by mail, a sealed proposal must be addressed to the Fresno County Department of Public Works and Planning, Office of the Design Engineer, Sixth Floor, Fresno County Plaza Building, 2220 Tulare Street, Fresno, CA 93721. All proposals shall be filed prior to the time and at the place specified in the NOTICE TO BIDDERS. Proposals received after the time for opening of the proposals will be returned to the bidder unopened.

1.07 IRREGULAR PROPOSALS

Proposals that do not conform to bid requirements may be rejected as nonresponsive. Proposals shall be considered irregular and may be rejected for various reasons, including but not limited to the following:

- A. The proposal forms furnished by the County are not used or are altered.
- B. There are unauthorized additions, conditional or alternate proposals or irregularities of any kind which tend to make the proposal incomplete or indefinite.
- C. The bidder adds any provision reserving the right to accept or reject an award, or to enter into a contract pursuant to an award.
- D. The bid fails to contain a price for each bid component.

1.08 DISQUALIFICATION OF BIDDERS

Any one or more of the following may be considered to constitute sufficient cause for disqualification of a bidder and rejection of that bidder's proposal:

- A. More than one proposal for the same work from an individual, partnership or corporation.
- B. Evidence of collusion among bidders. Participants in such collusion will receive no recognition as bidders for any future work of the County until such participant shall have been reinstated as a qualified bidder.
- C. Lack of competency or inadequate machinery, plant or other equipment as considered necessary to perform this project, as may be revealed by financial statement if required.
- D. Unsatisfactory performance record as shown by past work for the County, judged from the standpoint of workmanship and progress.
- E. Prior commitments or obligations which in the judgment of the County might hinder or prevent the prompt completion of the work.

- F. Failure to pay, or satisfactorily settle, all bills due for labor or materials which remain pending under any former contract(s) at the time of submittal of the bid for this project.
- G. Failure to comply with any prequalification requirements of the County.
- H. Failure to furnish full amount of Proposal Guarantee with bid or failure to sign bid bond.

1.09 WITHDRAWAL OR REVISION OF PROPOSALS

A bidder may, without prejudice, withdraw a proposal after it has been deposited, provided the request for such withdrawal is received in writing before the time set for opening proposals. The request shall be executed by the bidder or the bidder's duly authorized representative and shall include the name of the individual authorized to receive the withdrawn proposal. Said individual shall be required to present photo identification prior to withdrawing the proposal. The bidder may then submit a revised proposal provided it is received prior to the time set for opening proposals.

1.10 PUBLIC OPENING OF PROPOSALS

Proposals will be opened and read publicly at the time and place indicated in the Notice to Bidders. Bidders or their authorized agents are invited to be present.

1.11 BID PROTEST PROCEDURE / RELIEF OF BIDDER

A. BID PROTEST PROCEDURE

Any bid protest must be submitted in writing and delivered by the Bidder by either of the following means: (1) via e-mail to DesignServices@fresnocountyca.gov; or (2) via certified mail, return receipt requested to the following address: Design Division, Department of Public Works and Planning, 2220 Tulare Street, Sixth Floor, Fresno, CA 93721.

The bid protest must be received no later than 5:00 p.m. of the seventh (7th) calendar day following the deadline for submittal of the specific bid document(s) placed at issue by the protest. Any Bidder filing a protest is encouraged to submit the bid protest via e-mail, because the deadline is based on the Department's receipt of the bid protest. A bid protest accordingly may be rejected as untimely if it is not received by the deadline, regardless of the date on which it was postmarked. The Bidder's compliance with the following additional procedures also is mandatory:

The initial protest document shall contain a complete statement of the grounds for the protest, including a detailed statement of the factual basis and any supporting legal authority.

The protest shall identify and address the specific portion of the document(s) forming the basis for the protest.

The protest shall include the name, address and telephone number of the person representing the protesting party.

The Department will provide a copy of the initial protest document and any attached documentation to all other Bidders or proposers who appear to have a reasonable prospect of receiving an award depending upon the outcome of the protest.

The Board of Supervisors will issue a decision on the protest. If the Board of Supervisors determines that a protest is frivolous, the party originating the protest may be determined to be irresponsible and that party may be determined to be ineligible for future contract awards.

The procedure and time limits set forth herein are mandatory and are the Bidder's sole and exclusive remedy in the event of a bid protest. Failure by the Bidder to comply with these procedures shall constitute a waiver of any right to further pursue the bid protest, including the subsequent filing of a Government Code Claim or legal proceedings.

B. RELIEF OF BIDDER

A bidder who claims a mistake in their bid must follow the procedures in Public Contract Code Section 5100 et seq in seeking relief of their bid.

1.12 AWARD OF CONTRACT

The award of the contract, if it is awarded, will be to the lowest responsible bidder whose proposal complies with all the prescribed requirements. The award, if made, will be within 54 days after the opening of proposals.

If the County finds that it will be unable to award the contract within 54 calendar days after the opening of proposals, the Director may request any or all bidders to extend all terms of their proposal(s) to a specified date. It is possible that additional extensions may subsequently be requested. If a bidder does not elect to extend the terms of their proposal beyond the 54 calendar days following opening of proposals, or does not respond within 10 days to any request for an extension, that bidder's proposal will be deemed as having expired 54 calendar days following opening of the proposals, and that bidder's proposal will not be considered for award of the contract.

The successful bidder will be notified in writing, by letter mailed to the address shown on their proposal, that their bid has been accepted and that they have been awarded the contract.

The right is reserved by the County to reject any or all proposals, to waive technicalities (such as immaterial bid irregularities), to advertise for new proposals, or to proceed to do this work otherwise, if in the judgment of the awarding authorities the best interests of the County will be promoted thereby.

1.13 CANCELLATION OF AWARD

The awarding authority reserves the right to cancel the award of any contract at any time before the execution of said contract by all parties without any liability against the County.

1.14 CONTRACT BONDS

The bidder to whom the award is made shall, within ten days, enter into a written contract with the County. The bidder shall forfeit the proposal guarantee in case the bidder does not follow through with execution of the written contract within ten days after the contract is awarded.

The successful bidder shall furnish a faithful performance bond in the amount of 100 percent (100%) of the contract amount and a payment bond in the amount of 100 percent (100%) of the contract amount, and one-year Warranty Bond in the amount of 10 percent (10%) of the contract amount. Said bonds shall be submitted in triplicate.

The payment bond shall contain provisions such that if the Contractor or their subcontractors shall fail to pay (a) amounts due under the Unemployment Insurance Code with respect to work performed under the contract, or (b) any amounts required to be deducted, withheld and paid over to the Employment Development Department and to the Franchise Tax Board from the wages of the employees of the Contractor and subcontractors pursuant to Section 13020 of the Unemployment Insurance Code with respect to such work and labor, then the surety will pay these amounts. In case suit is brought upon the payment bond, the surety will pay a reasonable attorney's fee to be fixed by the court.

The contract form is attached hereto for the Contractor's information only. Execution of the contract by the successful bidder will not be required until after the bid award is made. Liability and Workers Compensation Insurance requirements shall be as set forth in the Agreement.

1.15 BUILDERS RISK INSURANCE

The Contractor shall obtain and maintain in force Builder's Risk Insurance against loss or damage from all perils. The policy shall cover the entire structure on which the work of this contract is to be done, up to the full insurable value thereof (except that if the contract is for remodeling, alteration, repair, or maintenance, then the policy shall cover the value of the contract therefore), including items of labor and materials connected therewith on the site, materials in place or to be used as part of the permanent construction including materials stored and partially paid for by the County as provided in Division 00-General Conditions, surplus materials, shanties, protective fences, bridges, or temporary structures, miscellaneous materials and supplies incident to the work, and such scaffolding, stagings, towers, forms and equipment as are not owned or rented by the Contractor, the cost of which is included in the cost of the work. EXCLUDED: This insurance does not cover any tools owned by mechanics, any tools, equipment, scaffolding, staging, towers, and forms owned or rented by the Contractor, the capital value of which is not included in the cost of the work, or any structures erected for the Contractor's administration of the project.

All subcontractors shall be insured to the extent of their portion of the work under the Contractor. The Contractor shall request, and is responsible to confirm with its insurer, that

the County and all subcontractors are named, both as additional insured and as additional loss payees, on the Builder's Risk insurance policy. The County, Contractor, and all subcontractors waive all rights, each against the others, for damages arising from perils covered by the insurance required under the terms of this article, except such rights as they may have to the proceeds of the Builder's Risk insurance obtained and maintained by the Contractor. The Contractor shall file a certificate of such insurance with the County upon issuance of the policy, and with any subcontractors upon its request.

1.16 POST-BID / PRE-AWARD INFORMATION

Within eight calendar days after bid opening, the apparent low bidder shall submit the following information to the Engineer:

- a. A cost distribution of the bid, with costs shown for major items of work as defined by either the project specification index, the Uniform Construction Index (UCI), or other method as appropriate for the project and approved by the Engineer.
- b. The cost distribution shall distinguish between work to be done by the bidder's own forces and work that will be subcontracted (including those who are to furnish materials or equipment fabricated to a special design); all subcontractors shall be named, regardless of the dollar amount of subcontracted work. Bidders' attention is also directed to California Public Contract Code Section 4100 et seq regarding subcontracting.

The County reserves the right to reject any proposed subcontractor, installer, or supplier who cannot show satisfactory evidence of meeting the qualifications required by the specification documents. In the event of such rejection, the apparent low bidder shall, within five working days, submit the name and qualifications of a replacement subcontractor, installer or supplier satisfactory to the County. Such replacement submittal shall be in accordance with all specification requirements.

No adjustment of bid prices shall be made in the event of such replacement.

This information may be used in the evaluation of bids. If the project is awarded, the cost distribution will be used in determining amounts payable on progress payments and final payment.

The County may request that bidders other than the apparent low bidder submit similar cost distribution or qualification information, for the purpose of evaluating bids.

Upon completion of the bid evaluation process, cost distributions or qualification information submitted by other than the apparent low bidder will be returned upon request.

END OF SECTION

BIDDERS' CHECKLIST (BUILDING CONTRACTS)

Because of numerous technical irregularities resulting in rejected proposals for projects, the following checklist is offered for the bidders' information and use in preparing the proposal. This checklist is not to be considered as part of the contract documents. Bidders are cautioned that deleting or not submitting a form supplied in the bid documents (even if the form does not require signature) may result in an irregular bid.

PROPOSAL/BID SHEET (Section 004213)

Bidder name on each sheet. Price for each item including: each additive, deductive, supplemental or alternate items. Make no additions such as "plus tax", "plus freight", or conditions such as "less 2% if paid by 15th". Use ink or typewriter. Acknowledge addenda.

BID SECURITY FORM - Read the Notices and Notes (Section 004313)

Indicate type of bid security provided.
Provide contract license information.

State business name and if business is a:

Corporation - list officers

Partnership - list partners

Joint Venture - list members

If Joint Venture members are corporations or partnerships, list their officers or partners.

Individual - list Owner's name and firm name style

Signature of Bidder –BID MUST BE SIGNED!

Corporation - by an officer

Partnership - by a partner

Joint Venture - by a member

Individual - by the Owner

If signature is by a Branch Manager, Estimator, Agent, etc., the bid must be accompanied by a power of attorney authorizing the individual to sign bids, otherwise the bid may be rejected.

Business Address - Firm's Street Address

Mailing Address - P.O. Box or Street Address

BID SECURITY (PROPOSAL GUARANTEE)

Ten percent (10%) of the total amount bid (to include supplemental or additive items).

Type of Bid Security:

Cash - Not recommended; cash is deposited in a clearing account and is returned to bidders by County warrant. This process may take several weeks.

Cashier's or Certified Checks - Will be held until the bid is no longer under consideration. If submitted by a potential awardee, they will be returned when the contract bonds are submitted and approved.

Bid Bonds - Must be signed by the bidder and by the attorney-in-fact for the bonding company. Signature of attorney-in-fact should be notarized and the bond should be accompanied by bonding company's affidavit authorizing attorney-in-fact to execute bonds. An unsigned bid bond will be cause for rejection. If the bid is submitted electronically, then the bidder must either attach an electronic bid bond or provide an original bid bond (or other form of bid security authorized by Public Contract Code Section 20129(a)), prior to the bid opening, as more thoroughly specified in the Instructions to Bidders, Section 1.04.A ("Electronic Bid Submittal").

SUBCONTRACTOR LIST (Section 004336)

One firm for each type of work to be subcontracted. Fill out as completely as possible. Name and location of place of business, California contractor's license number, public works contractor registration number issued pursuant to Section 1725.5 of the Labor Code, and description of work to be performed are required to be listed for each subcontractor in accordance with Public Contract Code section 4104.

NON-COLLUSION DECLARATION (Section 004519)

Must be completed, signed, and returned with bid.

TITLE 13 CARB CERTIFICATION (Section 004556)

Contractors, if applicable, must submit valid Certificates of Reported Compliance with their bid. Subcontractor certificates will be due no later than 4:00 PM on the fifth (5th) calendar day after the bid opening if not submitted with the bid.

GUARANTY OF WORK (Section 006536)

Does not need to be submitted with the bid. (Must be signed and submitted by the successful bidder together with the executed contract and requisite bonds and insurance certificates, within ten days after award of the Project.)

OTHER

If the bid forms have been removed from the specifications booklet, staple the pages together.

Make sure the bid envelope is sealed and shows the project name, bid package and contract number.

If the bid is mailed, allow sufficient time for postal delivery prior to the bid closing time. Bids received after the scheduled time will be returned unopened. Be sure the statement "**DO NOT OPEN UNTIL TIME OF BID OPENING**" is on the envelope.

END OF SECTION

PROPOSAL TO THE BOARD OF SUPERVISORS

C O U N T Y O F F R E S N O

Contract: **ENVIRONMENTAL COMPLIANCE CENTER
EDUCATIONAL BUILDING**

Contract No.: **24-S-01**

Fund / Subclass / Org / Account / Program or Memo No.: **9015 / 8150 / 91440**

Work to be performed:

The work to be done is shown on a set of Plans, entitled: "Environmental Compliance Center Educational Building"

Building No.: **TBD**

Project Address:

**1327 West Dan Ronquillo Drive
Fresno, CA 93706**

In case of a discrepancy between words and figures, the words shall prevail.

If this proposal shall be accepted and the undersigned shall fail to contract, as aforesaid, and to give the two bonds in the sums to be determined as aforesaid, each issued by a surety satisfactory to the Awarding Authority, within ten (10) days after the award of the contract, the Awarding Authority, at its option, may determine that the bidder has abandoned the contract, and thereupon this proposal and the acceptance thereof shall be null and void, and the forfeiture of such security accompanying this proposal shall operate and the same shall be the property of the County.

The undersigned, as bidder, declares that all addenda issued with respect to this bid have been received and incorporated into this Proposal. The bidder's signature on this Proposal also constitutes acknowledgement of all addenda.

The undersigned, as bidder, declares that the only persons, or parties interested in this proposal as principals are those named herein; that this proposal is made without collusion with any other person, firm or corporation; that the bidder has carefully examined the annexed proposed form of contract, and the plans therein referred to; and the bidder proposes and agrees if this proposal is accepted, that the bidder will contract with the County of Fresno to provide all necessary machinery, tools, apparatus and other means of construction, and to do all the work and furnish all the materials specified in the contract in the manner and time therein prescribed, and according to the requirements of the County as therein set forth, and that the bidder will take in full payment therefor the following lump sum price, to-wit:

BIDDER: _____

| | |
|--|----------|
| Contract No.: 24-S-01 Project: Environmental Compliance Center Educational Building | |
| Lump Sum Price Written In Words | |
| 1.) Base Bid | |
| _____ Dollars | \$ _____ |

| | | | |
|------------------------------------|-------------|--------------------|-------------|
| Acknowledgment of Addendum: | | | |
| Addendum No. _____ | Dated _____ | Addendum No. _____ | Dated _____ |
| Addendum No. _____ | Dated _____ | Addendum No. _____ | Dated _____ |

END OF PROPOSAL FORM
END OF SECTION

BID SECURITY FORM

CONTRACT: ENVIRONMENTAL COMPLIANCE CENTER EDUCATIONAL BUILDING

CONTRACT: #24-S-01

Accompanying this proposal is security (check one only) in an amount equal to at least ten percent (10%) of the total amount of the bid:

Bid Bond ; Certified Check ; Cashier's Check ; Cash (\$ _____)

The names of all persons interested in the foregoing proposal as principals are as follows:

Business Name _____

Note: If bidder or other interested person is a corporation, state legal name of corporation. If bidder is a co-partnership, state true name of firm.

Business Owners and Officers Names _____

Note: If bidder or other interested person is:

- a corporation, list names of the president, secretary, treasurer and manager thereof
- a partnership, list names of all individual co-partners composing firm.
- an individual, state first and last name in full.

Names of Owners and Key Employees _____

Note: List majority owners of your firm. If multiple owners, list all. Also include anyone, including key employees, who are actively promoting the contract. (SB1439)

Licensed in accordance with an act providing for the registration of Contractors:

Class _____ Contractor License No. _____ Expires _____

DIR Registration Number _____

Business Address: _____
Zip Code _____

Mailing Address: _____
Zip Code _____

Business Phone: (_____) _____ Fax Number: (_____) _____

Email Address _____

Signature of Bidder: _____ Dated: _____

NOTE: If bidder is a corporation, the legal name of the corporation shall be set forth above together with the signature of the officer or officers authorized to sign contracts on behalf of the corporation; if bidder is a co-partnership, the true name of the firm shall be set forth above together with the signature of the partner or partners authorized to sign contracts on behalf of the co-partnership; and if bidder is an individual, their signature shall be placed above. If signature is by an agent, other than an officer of a corporation or a member of a partnership, a Power of Attorney must be on file with the Owner prior to opening bids or submitted with the bid; otherwise, the bid will be disregarded as irregular and unauthorized.

END OF SECTION

CONTRACT # 24-S-01

BIDDER: _____

SUBCONTRACTORS

The following named subcontractor(s) will perform with labor, or otherwise render services to the general contractor in or about the construction of the work or improvement in an amount in excess of one-half of one percent of the total bid presented herewith. Submission of subcontractor's name, location of business and description of work, California contractor's license number and public works contractor registration number issued pursuant to Section 1725.5 of the Labor Code, all are REQUIRED, by Section 4104 of the California Public Contract Code, to be submitted prior to bid opening. (The "location of business" must specify the city in which the subcontractor's business is located, and the state if other than California.) All other requested information shall be submitted, either with the bid or within 24 hours after bid opening.

Please fill out as completely as possible when submitting your bid. Use subcontractor's business name style as registered with the License Board.

FAILURE TO LIST SUBCONTRACTORS AS DIRECTED MAY RENDER THE BID NON-RESPONSIVE, OR MAY RESULT IN ASSESSMENT OF A PENALTY AGAINST THE BIDDER IN ACCORDANCE WITH SECTION 4110 OF THE CALIFORNIA PUBLIC CONTRACT CODE.

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

BIDDER: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

BIDDER: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

BIDDER: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

BIDDER: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

SUBCONTRACTOR: _____

Business Address: _____

Class: _____ License No. _____ DIR Registration No. _____

Item No. or Description of Work: _____

Dollar Amount: _____ **OR** Percentage of Total Bid: _____

Email Address: _____

CONTRACT: ENVIRONMENTAL COMPLIANCE CENTER EDUCATIONAL BUILDING
CONTRACT NO.: 24-S-01

To the Board of Supervisors, County of Fresno:

NONCOLLUSION DECLARATION TO BE EXECUTED BY BIDDER AND SUBMITTED WITH
BID *

The undersigned declares:

I am the _____ of
(Owner, Partner, Corporate Officer (list title), Co-Venturer)

_____, the party making the
foregoing bid.

The bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation. The bid is genuine and not collusive or sham. The bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid. The bidder has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or refrain from bidding. The bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder. All statements contained in the bid are true. The bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof, and has not paid, and will not pay, any person or entity for that purpose.

Any person executing this declaration on behalf of a bidder that is a corporation, partnership, joint venture, limited liability company, limited liability partnership, or any other entity, hereby represents that he or she has full power to execute, and does execute, this declaration on behalf of the bidder.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this declaration is executed on _____, 2024,
at _____, _____.”
[city] [state]

(Printed or Typed Name)

(Signature)

(See Title 23 United States Code Section 112; Calif Public Contract Code Section 7106)

* NOTE: Completing, signing, and returning the Non-collusion Declaration is a required part of each Proposal. Bidders are cautioned that making a false certification may subject the certifier to criminal prosecution.

END OF SECTION

TITLE 13, CALIFORNIA CODE OF REGULATIONS § 2449(I) GENERAL REQUIREMENTS FOR IN-USE OFF-ROAD DIESEL-FUELED FLEETS

In conformance with Title 13 § 2449(i), bidders will be required to attach copies of valid Certificates of Reported Compliance for the fleet selected for the contract and their listed subcontractors.

Before May 15th of each year, the prime contractor must collect a new valid Certificate of Reported Compliance for the current compliance year, as defined in section 2449(n), from all fleets that have an ongoing contract with the prime contractor as of March 1 of that year. Prime contractors must not write contracts to evade this requirement. Annual renewals must be provided to the Resident Engineer at least one week prior to the expiration date of the current certificate.

<https://ww2.arb.ca.gov/resources/fact-sheets/fact-sheet-contracting-requirements>

Choose all that apply:

- Bidder's Certificate of Reported Compliance has been attached to the bid.
- Bidder does not have a fleet subject to this regulation as outlined in Section 2449(i)(1)-(4).
- Listed subcontractors' certificates have been attached or will be submitted within five (5) calendar days of the bid opening.
- The following subcontractors do not have a fleet subject to this regulation as outlined in Section 2449(i)(1)-(4):

| | |
|-------|-------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

FAILURE TO PROVIDE THE CERTIFICATES OF REPORTED COMPLIANCE AS DIRECTED MAY RENDER THE BID NON-RESPONSIVE.

AGREEMENT

THIS AGREEMENT is made at Fresno, in Fresno County, California, by and between _____, hereinafter "Contractor", and the County of Fresno, hereinafter "Owner".

WITNESSETH, the Contractor and the Owner, for the consideration hereinafter named, agree as follows:

ARTICLE I. The Contractor agrees to furnish all labor, equipment and materials, including tools, implements, and appliances required, and to perform all the work in a good and workmanlike manner, free from any and all liens and claims of mechanics, materialmen, subcontractors, artisans, machinists, teamsters, and laborers required for:

Educational Compliance Center Educational Building Contract No. 24-S-01

Located at 1327 West Dan Ronquillo Drive, Fresno, California, all in strict compliance with the plans, drawings, and specifications therefore prepared by the Director of the Fresno County Department of Public Works and Planning and his authorized representatives, hereinafter called the Project Manager, and other contract documents relating thereto.

ARTICLE II. The Contractor and the Owner agree that the Advertisement (Notice to Bidders), the Wage Scale, the Proposal hereto attached, the Instructions to Bidders, the General Conditions of the contract, the Technical Specifications, the Drawings, and the Addenda and Bulletins thereto, the Contract Bonds and Certificates of Liability and Workers Compensation Insurance, and the Contract Change Orders, together with this Agreement form the Contract Documents, and they are as fully a part of the contract as if hereto attached or herein repeated. The Specifications and Drawings are intended to cooperate so that any work exhibited in the drawings and not mentioned in the specifications, or vice versa, is to be executed the same as if both are mentioned in the specifications and set forth in the drawings, to the true intent and meaning of the said drawings and specifications when taken together. Provided, however, that no part of said specifications that is in conflict with any portion of this Agreement, or that is not actually descriptive of the work to be done thereunder, or of the manner in which the said work is to be executed, shall be considered as any part of this Agreement, but shall be utterly null and void, and anything that is expressly stated, delineated or shown in or upon the specifications or Detailed Scope of Work shall govern and be followed, notwithstanding anything to the contrary in any other source of information or authority to which reference may be made.

ARTICLE III. The Contractor agrees that the work under the contract shall be completed as determined by the Owner within **One Hundred and Twenty (120) CALENDAR DAYS** from the date shown in the Notice to Proceed. Time of performance shall be deemed as of the essence hereof and it is agreed that actual damages to the Owner from any delay in completion beyond the date provided for herein, or any extension thereof until the work is completed or accepted, shall be all provable damages plus liquidated damages in the amount of **Five Thousand and 00/100 DOLLARS (\$5000.00)** per day; that said liquidated damage was arrived at by a studied estimate of loss to the Owner in the event of a delay considering the following damage items which are extremely difficult or impossible to determine: Additional construction expense resulting from delay of completion including, but not limited to, engineering, inspection, rental and utilities; provided, however, the Owner may conditionally accept the work and occupy and

use the same if there has been such a degree of completion as shall in its opinion render the same safe, fit and convenient for the use for which it is intended and in such cases the Contractor and Surety shall not be charged for liquidated damages for any period subsequent to such conditional acceptance and occupation by the Owner but Owner may assess actual damages caused by failure of total completion during such period. The time during which the Contractor is delayed in said work by the acts or neglects of the Owner or its employees or those under it by contract or otherwise, or by the acts of God which the Contractor could not have reasonably foreseen and provided for, or by storms and inclement weather which delays the work, or by any strikes, boycotts, or like obstructive action by employee or labor organizations, or by any general lockouts or other defensive action by employers, whether general, or by organizations of employers, shall be added to the time for completion as aforesaid.

ARTICLE IV. COMPENSATION: The Owner agrees to make payments on account thereof as provided in the General Conditions in the total amount of _____ **AND** /100 DOLLARS (\$ _____) in current funds for the performance of the contract which sum is computed as follows: **TOTAL BID LUMP SUM.**

ARTICLE V. The Contractor and the Owner agree that changes in this Agreement or in the work to be done under this Agreement shall become effective only when written in the form of a supplemental agreement or change order and approved and signed by the Owner and the Contractor. It is specifically agreed that the Owner shall have the right to request any alterations, deviations, reductions, or additions to the contract, plans, and/or specifications and the amount of the cost thereof shall be added to or deducted from the amount of the contract price aforesaid by fair and reasonable valuations thereof.

This contract shall be deemed completed when the work is finished in accordance with all Contract Documents as amended by such changes. No such change or modification shall release or exonerate any surety upon any guaranty or bond given in connection with this contract.

ARTICLE VI. In the event of a dispute between the Owner or Project Manager and the Contractor as to an interpretation of any of the specifications or as to the quality of sufficiency of material or workmanship, the decision of the Project Manager shall for the time being prevail and the Contractor, without delaying the job, shall proceed as directed by the Project Manager without prejudice to a final determination by negotiation, arbitration by mutual consent or litigation and should the Contractor be finally determined to be either wholly or partially correct, the Owner shall reimburse him for any added costs he may have incurred by reason of work done or material supplied beyond the terms of the contract as a result of complying with the Project Manager's directions as aforesaid. In the event the Contractor shall neglect to prosecute the work properly or fail to perform any provisions of this contract, the Owner, after three days' written notice to the Contractor, may, without prejudice to any other remedy it may have, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due to the Contractor, subject to final settlement between the parties as in this paragraph hereinabove provided.

ARTICLE VII. TERMINATION: If the Contractor should be adjudged a bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, or if he or any of his subcontractors should persistently violate any of the provisions of the contract, or if he should persistently or repeatedly refuse or should fail, except in cases for which extension of time is provided, to supply enough properly skilled

workmen or proper material, or if he should fail to make prompt payment to subcontractors or for material or labor or persistently disregard laws, ordinances or the instructions of the Project Manager, then the Owner may, upon the certificate of the Project Manager, when sufficient cause exists to justify such action, serve written notice upon the Contractor and his surety of its intention to terminate the contract, such notice to contain the reasons for such intention to terminate the contract, and unless within five (5) days after the serving of such notice, such violations shall cease and satisfactory arrangements for correction thereof be made, the contract shall, upon the expiration of said five days, cease and terminate.

In the event of any such termination, the Owner shall immediately serve written notice thereof upon the surety and the Contractor, and the surety shall have the right to take over and perform the contract, provided, however, that if the surety within ten (10) days after the serving upon it of notice of termination does not give the Owner written notice of its intention to take over and perform the contract or does not commence performance thereof within the ten (10) days stated above from the date of the serving of such notice, the Owner may take over the work and prosecute the same to completion by contract or by any other method it may deem advisable for the account and at the expense of the Contractor, and the Contractor and his surety shall be liable to the Owner for any excess cost occasioned the Owner thereby, and in such event the Owner may without liability for so doing, take possession of and utilize in completing the work, such materials, appliances, plant and other property belonging to the Contractor as may be on the site or the work and necessary therefore. In such case, the Contractor shall not be entitled to receive any further payment until the work is finished.

If the unpaid balance of the contract price shall exceed the expense of finishing the work, including compensation for additional managerial and administrative services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the Owner. The expense incurred by the Owner as herein provided, and damage incurred through the Contractor's default, shall be certified by the Project Manager.

ARTICLE VIII. The Contractor and his subcontractors shall comply with Sections 1770 – 1780 of the California Labor Code and the provisions of Sections 2.52 and 2.55 of the General Conditions concerning the payment of wages to all workers and mechanics, and the employment and payment of apprentices by the Contractor or any subcontractor for all work performed under this Agreement.

ARTICLE IX. The Contractor and his subcontractors shall comply with Sections 1810 to 1815 of the California Labor Code and the provisions of Section 2.51 of the General Conditions, concerning hours of work and payment of overtime compensation for all work performed under this Agreement.

The Board of Supervisors hereby specifies that portions of the work can only be performed outside the regular working hours as defined in the applicable collective bargaining agreement filed with the Director of Industrial Relations in accordance with Labor Code Section 1773.1, and that the overtime requirements for Saturdays, and holidays are hereby waived for these portions of the work, as more particularly described in the specifications. However, this exemption shall not negate the overtime provisions specified in Labor Code Section 1815.

ARTICLE X. INDEMNIFICATION: To the fullest extent permitted by law, Contractor agrees to and shall indemnify, save, hold harmless and at County's request, defend County and its officers, agents and employees, and the Project Manager and their respective officers, agents and employees, from any and all costs and expenses, attorney fees and court costs, damages,

liabilities, claims and losses occurring or resulting to County, or the Project Manager in connection with the performance, or failure to perform, by Contractor, its officers, agents or employees under this Agreement, and from any and all costs and expenses, attorney fees and court costs, damages, liabilities, claims and losses occurring or resulting to any person, firm or corporation who may be injured or damaged by the performance, or failure to perform, of Contractor, its officers, agents or employees under this Agreement. In addition, Contractor agrees to indemnify County for Federal, State of California and/or local audit exceptions resulting from non-compliance herein on the part of Contractor.

In any and all claims against the County, the Project Manager, or any of their respective officers, agents or employees, initiated by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation set forth in the immediately preceding paragraph shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under workmen's compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE XI. INSURANCE: Without limiting the Owner's right to obtain indemnification from Contractor or any third parties, Contractor, at its sole expense, in accordance with the provisions of Section 2.40 of the General Conditions, shall maintain in full force and effect the following insurance policies throughout the term of this Agreement, excepting only those policies for which a longer term is specified:

- A. Course of Construction (Builder's All Risk) Insurance, with scope and amount of coverage as specified in Section 2.40 E.1 of the General Conditions.
- B. Commercial General Liability Insurance, with scope and amount of coverage as specified in Section 2.40 E.2 of the General Conditions.
- C. Automobile Liability Insurance, with scope and amount of coverage as specified in Section 2.40 E.2 of the General Conditions.
- D. Professional Liability Insurance, with scope and amount of coverage as specified in Section 2.40 E.3 of the General Conditions.
- E. Worker's Compensation Insurance, with scope and amount of coverage as specified in Section 2.40 E. 4 of the General Conditions.

The Certificate of Insurance shall be issued in triplicate, to the County of Fresno, and all other participating agencies, whether or not said agencies are named herein, who contribute to the cost of the work or have jurisdiction over areas in which the work is to be performed and all officers and employees of said agencies while acting within the course and scope of their duties and responsibilities.

ARTICLE XII. MISCELLANEOUS PROVISIONS:

1. AUDITS AND INSPECTIONS: The Contractor shall at any time during business hours, and as often as the Owner may deem necessary, make available to the Owner for examination all of its records and data with respect to the matters covered by this Agreement. The Contractor shall, upon request by the Owner, permit the Owner to audit and inspect all of such records and data necessary to ensure Contractor's compliance with the terms of this Agreement. If this Agreement exceeds ten thousand dollars (\$10,000.00), Contractor shall be subject to the examination and audit of the Auditor General for a period of three (3) years after final payment under contract (Government Code Section 8546.7).

2. INDEPENDENT CONTRACTOR: In performance of the work, duties, and obligations assumed by Contractor under this Agreement, it is mutually understood and agreed that Contractor, including any and all of Contractor officers, agents, and employees will at all times be acting and performing as an independent contractor, and shall act in an independent capacity and not as an officer, agent, servant, employee, joint venture, partner, or associate of the Owner. Contractor and Owner shall comply with all applicable provisions of law and the rules and regulations, if any, of governmental authorities having jurisdiction over matters of the subject thereof. Because of its status as an independent contractor, Contractor shall have absolutely no right to employment rights and benefits available to Owner's employees. Contractor shall be solely liable and responsible for providing to, or on behalf of, its employees all legally-required employee benefits. In addition, Contractor shall be solely responsible and save Owner harmless from all matters related to payment of Contractor's employees, including compliance with social security, withholding, and all other regulations governing such matters. It is acknowledged that during the term of this Agreement, Contractor may be providing services to others unrelated to the Owner or to this Agreement.

3. DISCLOSURE OF SELF-DEALING TRANSACTIONS: This provision is only applicable if the Contractor is operating as a corporation (a for-profit or non-profit corporation) or if during the term of the agreement, the Contractor changes its status to operate as a corporation. Members of the Contractor's Board of Directors shall disclose any self-dealing transactions that they are a party to while Contractor is providing goods or performing services under this agreement. A self-dealing transaction shall mean a transaction to which the Contractor is a party and in which one or more of its directors has a material financial interest. Members of the Board of Directors shall disclose any self-dealing transactions that they are a party to by completing and signing a Self-Dealing Transaction Disclosure Form, attached hereto as Exhibit A and incorporated herein by reference, and submitting it to the Owner prior to commencing with the self-dealing transaction or immediately thereafter.

ARTICLE XIII. The Contractor represents that he has secured the payment of Workers Compensation in compliance with the provisions of the Labor Code of the State of California and Paragraphs B.3, C.3 and E.4 of Article 2.40 of the General Conditions, and that he will continue so to comply with such statutory and contractual provisions for the duration and entirety of the performance of the work contemplated herein.

This Contract, **24-S-01**, was awarded by the Board of Supervisors on _____, 2024.
It has been reviewed by the Department of Public Works and Planning and is in proper
order for signature of the Chairman of the Board of Supervisors.

IN WITNESS WHEREOF, they have executed this Agreement this _____ day of
_____, 2024

(CONTRACTOR)

COUNTY OF FRESNO

(OWNER)

(Taxpayer Federal I.D. No.)

By: _____

Name: _____

Title: _____

By: _____

Nathan Magsig, Chairman
of the Board of Supervisors of the
County of Fresno

ATTEST:
Bernice E. Seidel
Clerk of the Board of Supervisors
County of Fresno, State of
California

By: _____

Deputy

FOR ACCOUNTING USE ONLY
VARIOUS ORGS.
9015 / 8150 / 91440

END OF SECTION

SELF-DEALING TRANSACTION DISCLOSURE FORM

In order to conduct business with the County of Fresno (hereinafter referred to as “County”), members of a corporation’s board of directors of the Consultant, must disclose any self-dealing transactions that they are a party to while providing goods, performing services, or both for the County. A self-dealing transaction is defined below:

“A self-dealing transaction means a transaction to which the corporation is a party and in which one or more of its directors has a material financial interest”

The definition above will be utilized for purposes of completing this disclosure form.

INSTRUCTIONS

- (1) Enter board member’s name, job title (if applicable), and date this disclosure is being made.
- (2) Enter the board member’s company/agency name and address.
- (3) Describe in detail the nature of the self-dealing transaction that is being disclosed to the County. At a minimum, include a description of the following:
 - a. The name of the agency/company with which the corporation has the transaction; and
 - b. The nature of the material financial interest in the Corporation’s transaction that the board member has.
- (4) Describe in detail why the self-dealing transaction is appropriate based on applicable provisions of the Corporations Code.
- (5) Form must be signed by the board member that is involved in the self-dealing transaction described in Sections (3) and (4).

| | | | |
|---|--|--------------|--|
| (1) Company Board Member Information: | | | |
| Name: | | Date: | |
| Job Title: | | | |
| (2) Company/Agency Name and Address: | | | |
| | | | |
| (3) Disclosure (Please describe the nature of the self-dealing transaction you are a party to): | | | |
| | | | |
| (4) Explain why this self-dealing transaction is consistent with the requirements of Corporations Code 5233 (a): | | | |
| | | | |
| (5) Authorized Signature | | | |
| Signature: | | Date: | |

CONTRACT NO: 24-S-01

This guaranty shall be executed by the successful bidder in accordance with Section 2.32 of the General Conditions. The bidder may execute the guaranty on this page at the time of submitting the bid or may, in the alternative, submit it with the insurance certificates and bonds within ten (10) days after award.

G U A R A N T Y

To the Owner: County of Fresno

The undersigned guarantees the construction and installation of the following work included in this project:

ALL WORK

Should any of the materials or equipment prove defective or should the work as a whole prove defective, due to faulty workmanship, material furnished or methods of installation, or should the work or any part thereof fail to operate properly as originally intended and in accordance with the plans and specifications, due to any of the above causes, all within twelve (12) months after the date on which this contract is accepted by the Owner, the undersigned agrees to reimburse the Owner, upon demand, for its expenses incurred in restoring said work to the condition contemplated in said project, including the cost of any such equipment or materials replaced and the cost of removing and replacing any other work necessary to make such replacement or repairs, or, upon demand by the Owner, to replace any such material and to repair said work completely without cost to the Owner so that said work will function successfully as originally contemplated.

The Owner shall have the unqualified option to make any needed replacement or repairs itself or to have such replacements or repairs done by the undersigned. In the event the Owner elects to have said work performed by the undersigned, the undersigned agrees that the repairs shall be made and such materials as are necessary shall be furnished and installed within a reasonable time after the receipt of demand from the Owner. If the undersigned shall fail or refuse to comply with their obligations under this guaranty, the Owner shall be entitled to all costs and expenses reasonably incurred by reason of said failure or refusal.

Name (Printed): _____

Signature: _____

Title: _____

Date: _____

Contractor: _____

END OF SECTION

GENERAL CONDITIONS

2.01 IDENTIFICATION OF CONTRACT

- A. The Agreement shall be signed by the Contractor and the Owner.
- B. The Contract Documents are defined in ARTICLE II of the Agreement.
- C. The Contract Documents form the Contract for Construction (“Contract”). This Contract represents the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification as defined above. The Contract Documents shall not be construed to create any contractual relationship of any kind between the Architect of record and the Contractor, but the Architect of record shall be entitled to performance of the obligations of the Contractor intended for their benefit and to enforcement thereof. Nothing contained in the Contract Documents shall create any contractual relationship between the Owner and any Subcontractor or Sub-subcontractor.

2.02 EXECUTION, CORRELATION, AND INTENT OF CONTRACT DOCUMENTS

- A. The Contract Documents are complementary and anything called for by one shall be supplied as if called for by all, providing it comes clearly within the scope of the Contract.
- B. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work. Words and abbreviations that have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings.
- C. Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become familiar with the local conditions under which the Work is to be performed, and has correlated personal observations with the requirements of the Contract Documents.
- D. All work and material shall be the best of the respective kinds specified or indicated. Should any workmanship or materials be required that are not directly or indirectly called for in the Contract Documents, but which nevertheless are necessary for proper fulfillment of the obvious intent thereof, said workmanship or materials shall be the same for similar parts that are detailed, indicated or specified, and the Contractor shall understand the same to be implied and provide for it in his/her tender as if it were particularly described or delineated.

2.03 OWNERSHIP AND USE OF DOCUMENTS

All Contract Documents and copies thereof furnished shall remain the property of the Owner. With the exception of one (1) contract set for each party to the Contract, such documents are to be returned by Contractor or suitably accounted for to the Owner upon request at the completion of the Work. Submission or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's common law copyright or other reserved rights. The Owner's use of the documents will not increase the Architect's design liability beyond the Project and the site for which the design was originally intended.

2.04 DEFINITIONS

The following words, or variations thereof, as used in these documents have meanings as defined:

- A. The Work - The Work comprises the completed construction required of the Contractor by the Contract Documents, and includes all labor, materials, equipment and services necessary to produce such construction, and all materials, other permits and equipment incorporated or to be incorporated in such construction.
- B. The Project – The collective improvements to be constructed by the Contractor pursuant to the construction of the Sheriff Substation, Vehicle/Evidence Storage building, parking, and associated site improvements for Fresno County.
- C. Owner - The County of Fresno, State of California, as represented by the Fresno County Board of Supervisors and so named in the Agreement. The term Owner additionally includes the Owner's authorized representative (also known as the Project Manager) for this Project.
- D. Architect of record – The Owner and his/her authorized representative, as defined in Section 2.04C, or a duly California licensed Architect.
- E. Contractor - When used in the General Conditions refers to person(s) or entity (partnership or corporation) so named in Agreement and when used in the body of the Specifications, refers to the Contractor for that specific work, whether it be the General Contractor, Subcontractor, or other Contractor. The term Contractor means the Contractor or the Contractor's authorized representative.
- F. Subcontractor - Person, persons, entity, co-partnership or corporation having direct contract with Contractor to perform any of the Work at the site. The term Subcontractor means a Subcontractor or a Subcontractor's authorized representative. The term Subcontractor does not include any separate contractor or any separate contractor's subcontractors.

- G. Sub-subcontractor – Person, persons, entity, co-partnership or corporation having a direct or indirect contract with a Subcontractor to perform any of the Work at the site (i.e. a second-tier, third-tier or lower-tier Subcontractor). The term Sub-subcontractor means a Sub-subcontractor or an authorized representative thereof.
- H. Notice to Proceed - A written notice issued by the Owner directing the Contractor to proceed with construction activities to complete the Project.
- I. Technical Specifications – Contains the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.
- J. Days- All days shall be measured in calendar days unless specifically noted otherwise in these documents or referenced codes.
- K. Year- One year shall be measured in terms of 365 calendar days.

2.05 SPECIFICATIONS AND DRAWINGS

- A. Precedence – Anything mentioned in the Specifications and not shown on the Drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. Subject to Section 2.02, in cases of discrepancy concerning dimension, quantity and location, the Drawings shall take precedence over the Specifications. Explanatory notes on the Drawings shall take precedence over conflicting drawn indications. Large scale details shall take precedence over smaller scale details and figured dimensions shall take precedence over scaled measurement. Where figures are not shown, scale measurements shall be followed but shall in all cases be verified by measuring actual conditions of Work already in place. In cases of discrepancy concerning quality and application of materials and non-technical requirements over materials, the specifications shall take precedence over Drawings.
- B. Division of Specifications – For convenience of reference and to facilitate the letting of independent contracts, this specification may be separated into certain sections; such separation shall not operate to oblige the Owner, Architect or Professional Consultant to establish the limits of any contract between the Contractor and Sub-Contractor each of whom shall depend upon his/her own contract stipulations. The General Conditions apply with equal force to all work, including extra work.
- C. Governing Factors – Dimensions figured on drawings shall be followed in every case in preference to scale of drawings.

- D. Discrepancies – Should the Contractor, at any time, discover a discrepancy in a drawing or specification, or any variation between dimensions on drawings and measurements at site, or any lacking of dimensions or other information, he/she shall report at once to the Project Manager requesting clarification and shall not proceed with the work affected thereby until such clarification has been made. If the Contractor proceeds with work affected by such discrepancies, without having received such clarification, he/she does so at his/her own risk. Any adjustments involving such circumstances made by the Contractor, prior to approval by the Project Manager, shall be at the Contractor's risk and the settlement of any complications or disputes arising therefrom shall be at the Contractor's sole expense and Contractor shall indemnify, hold harmless and defend Owner, Owner's representatives, and Project Manager from any liability or loss with respect to said adjustments.
- E. Scope of Drawings – The drawings shall be held to determine the general character of the Work as well as its details. Parts not detailed shall be constructed in accordance with best standard practice for work of this class, so as to afford the requisite strength and logically complete the parts they compose. Where it is obvious that a drawing illustrates only a part of a given work or of a number of items, the remainder shall be deemed repetitious and so construed. The Contractor shall be responsible for all errors made in using any drawings which have been superseded.
- F. Shop Drawings, Product Data and Samples –
1. Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or any Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work. Samples are physical examples that illustrate materials, equipment or workmanship, and establish standards by which the work will be judged.
 2. The Contractor shall prepare, review, approve and submit to the Project Manager, with reasonable promptness and in such sequence as to cause no delay in the Work or in the work of the Owner or any separate contractor, all Shop Drawings, Product Data and Samples required by the Contract Documents.
 3. By preparing, approving and submitting Shop Drawings, Product Data and Samples, the Contractor represents that the Contractor has determined and verified all materials, field measurements and field construction criteria related thereto, or will do so with reasonable promptness, and has checked and coordinated the information contained within such submittals with the requirements of the Work, the Project, the Work Order and the Contract Documents.

4. The Contractor shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by the Architect's review of Shop Drawings, Product Data or Samples, unless the Contractor has specifically informed the Project Manager in writing of such deviation at the time of submission and the Architect has reviewed the specific deviation. The Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data or Samples by the Architect's review of them.
5. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications. The cost of such certifications shall be borne by the Contractor. Owner may elect to have an independent certification performed at its own expense. The Owner shall have final approving authority for performance-based items.
6. The Contractor shall direct specific attention, in writing or on resubmitted Shop drawings, Product Data, or Samples, to revisions other than those requested by the Architect on previous submittals.
7. No portion of the Work requiring submission of a Shop Drawing, Product Data or Sample shall be commenced until the submittal has been reviewed by the Architect. All such portions of the Work shall be in accordance with reviewed submittals.
8. Submission of Shop Drawings and Samples to the Project Manager is required for only those items specifically mentioned in the Specification Sections. If Contractor submits Shop Drawings for items other than the above, the Project Manager will not be obligated to distribute or review them. Contractor shall be responsible for the procuring of Shop Drawings for his/her own use as he/she may require for the progress of the Work.
9. The term "Shop Drawings" as used herein also includes but is not limited to fabrication, erection, layout and setting drawings, manufacturer's standard drawings, descriptive literature, catalogs, brochures, performance and test data, wiring and control diagrams, all other drawings and descriptive data pertaining to materials, equipment, piping, duct and conduit systems, and methods of construction as may be required to show that the materials, equipment or systems and the positions and layout of each conform to the Contract requirements. As used herein the term "manufactured" applies to standard units usually mass-produced, and the term "fabricated" means items specifically assembled or made out of selected materials to meet individual design requirements. Shop Drawings shall establish the actual detail of all manufactured or fabricated items; indicate proper relation to adjoining work; amplify design details of mechanical and electrical equipment in proper relation to physical spaces in the structure; and incorporate minor changes of design or construction to suit actual conditions.

10. Drawings: Following Contractor's review and approval, Contractor shall submit to the Project Manager for approval four (4) minimum to six (6) maximum prints and/or pdf submission of the same information via email. (Required delivery methods and quantities of submittals will be determined at the time of the Pre-Construction Meeting.) The Project Manager will check the submittal to see if it is complete. If complete, the Project Manager will forward the drawings to the Owner and the Architect. The Architect and Owner will check the drawings and note Architect and Owner comments and affix a stamp to the drawing s indicating the status of acceptance, and will return same to the Project Manager, each retaining prints for his/her records. The Architect or his/her consultants, as applicable, will review the Shop Drawings; mark the prints with required revisions; stamp the prints and indicate "No Exceptions Taken", "Make Corrections Noted", "Revise and Resubmit", "Submit Specified Item", or "Rejected", and return the prints. The Project Manager will return the prints to the Contractor. The Contractor shall then print and distribute the appropriate number of copies to his/her job personnel as required. If a drawing is stamped "Rejected" or "Revise and Resubmit", the Contractor shall correct and resubmit as outlined above. When stamped "Make Corrections Noted", or similar instructions, the Contractor shall correct and resubmit for record only, three (3) prints of each drawing. Also see Technical Specifications, Division I, General Requirements.
11. Samples: Following Contractor's review and approval, Contractor shall submit to the Architect, five (5) minimum samples of all materials in quantities and sizes as specified herein as requested by the Architect. Submittals shall be given to the Architect at a time determined by the Contractor, which allows for any necessary resubmittal and which will not cause any delay in the Work. Samples will be forwarded to the Architect. If a sample is stamped "Rejected" or "Revise and Resubmit", one sample so noted will be returned to the Contractor. The Contractor shall correct and resubmit as outlined above. If a sample is stamped "Make Corrections Noted", one sample so noted will be returned. Corrected samples shall be resubmitted for approval as per the original submittal. Also see Technical Specifications and General Requirements.
12. Brochures: Following Contractor's review and approval, Contractor shall submit to the Architect, five (5) copies of all manufacturer's catalogs or brochures as required. Brochures will be forwarded to the Architect for review. If a brochure is stamped "No Exception Taken", two (2) copies will be returned to the Contractor. If stamped "Rejected", one marked copy and two (2) unmarked copies will be returned. Corrected copies shall be resubmitted for approval as per the original submittal. Also see General Requirements.
13. Manufacturer's Instructions: Where any item or work is required by Specifications to be furnished, installed or performed in accordance with a specified product manufacturer's instructions, Contractor shall procure and distribute the necessary copies of such instructions to all concerned parties.

- G. Materials - All materials, unless otherwise specified, shall be new and of good quality, proof of which shall be furnished by the Contractor; in case of doubt as to kind or quality required, samples shall be submitted to the Architect through the Project Manager who will specify the kind and use of the material appropriate to the location and the function of the item in question. Contractor shall furnish such item accordingly. Before final payment, all material rejected by the Architect or Project Manager shall be promptly removed from the premises by the Contractor, whether or not completely installed, and promptly and properly replaced with correct materials, including any other work adjoining if disturbed, in accordance with the contract and without expense to the Owner; the Contractor also shall pay for work of other Contractors as is affected by such removals and replacements.

2.06 THE ARCHITECT

- A. The Owner may delegate all or a portion of its rights and responsibilities to a California licensed Architect as deemed necessary.
- B. The Architect advises the Project Manager in all aspects of the construction phase of the Project. The Architect's functions include advice and assistance to the Project Manager in the correct interpretation and application of the Contract Documents. The Architect is not authorized independently to issue Addenda, Clarifications, Field Orders, Work Authorizations, or Supplemental Work Orders, or in any other way to bind the Owner in discussions with the Contractor.
- C. The Contractor shall deliver all correspondence relating to the proper execution of the Work to the Project Manager. The Project Manager reserves the right to consult with the Architect and Owner prior to responding to the Contractor's correspondence.
- D. When discussions between the Contractor and the Project Manager occur either on the site or elsewhere, but the Architect is not present, the Project Manager reserves the right to consult with the Architect and Owner prior to issuing his/her final decision or instruction.
- E. The Architect shall review or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for conformance with the design concept of the Work and the information given in the Contract Documents. Such action shall generally be taken within ten (10) working days, however under certain circumstances such as very complex submittals or if large number of submittals are submitted at one (1) time it may take longer. In this case the Contractor will be notified and given the opportunity to advise the Architect of priorities. The Architect's review of a specific item shall not indicate review of an assembly of which the item is a component.

2.07 THE PROJECT MANAGER

- A. The Project Manager is the authorized representative of the Owner in all aspects of administering the construction contract on behalf of the Owner. All communications from and to the Contractor will be channeled through the Project Manager. However, the Project Manager does not have the authority to bind the Owner in matters affecting adjustments to the time or cost of the Project as defined in the Agreement for Construction.
- B. The Project Manager will be the Owner's representative during the construction and warranty periods, and until final payment to all contractors is due. The Project Manager will advise and consult with the Owner. All instructions to the Contractor shall be forwarded through the Project Manager. The Project Manager will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified by written instrument.
- C. The Project Manager will be on site during construction to monitor the progress and quality of the Work and to determine in general if the Work is proceeding in accordance with the Contract Documents. On the basis of on-site observations and communication with the Contractor, the Project Manager will keep the Owner informed of the progress of the Work, and will endeavor to guard the Owner against defects and deficiencies in the Work of the Contractor.
- D. The Project Manager shall at all times have access to the Work wherever it is in preparation and progress. The Contractor shall provide facilities for such access so that the Project Manager may perform its functions under the Contract Documents.
- E. Based on the Project Manager's observations, and an evaluation of the Contractor's Application for Payment, the Project Manager will determine the amount owing to the Contractor and will issue to the Owner Certificates for Payment incorporating such amount.
- F. The Project Manager will be the initial interpreter of the requirements of the Contract Documents and the initial judge of the performance hereunder by the Contractor. The Owner will have final authority of all such matters.
- G. The Project Manager will render interpretations necessary for the proper execution or progress of the Work, with reasonable promptness and in accordance with agreed upon time limits. Either party to the Contract may make written request to the Project Manager for such interpretations.
- H. Claims, disputes and other matters in question between the Contractor and the Project Manager relating to the execution or progress of the Work or the interpretation of the Contract Documents shall be referred to the Owner (or his/her designee).
- I. All interpretations and decisions of the Project Manager will be in writing or in graphic form, and shall be both consistent with the intent of the Contract Documents and reasonably inferable therefrom.

- J. The Project Manager will have the authority to reject, or recommend to the Owner the rejection, of any work that does not conform to the Contract Documents. Whenever, in the Project Manager's opinion, it is considered necessary or advisable for the implementation of the intent of the Contract Documents, the Project Manager will have authority to require special inspection or testing of the Work whether or not such work be then fabricated, installed or completed.
- K. The Project Manager will receive from the Contractor and review all Shop Drawings, Product Data and Samples, and forward same to Architect and Owner for review.
- L. Following consultation with the Owner, the Project Manager will take appropriate action on changes, and will have authority to order minor changes in the Work as provided herein.
- M. The Project Manager will conduct inspections to determine the date of Completion, and will receive and forward to the Owner for the Owner's review written warranties and related documents required by the Contract Documents and assembled by the Contractor. The Project Manager will issue a final Project Certificate for Payment upon compliance with the requirements for completion and final payment. The Project Manager will monitor the warranty for a period of 365 Calendar Days from and after the date of acceptance of the Work, unless otherwise specified as a longer term.
- N. The duties, responsibilities and limitations of authority of the Project Manager as the Owner's representative during construction, as set forth in the Contract Documents, will not be modified or extended without written consent of the Owner, the Contractor and the Project Manager, which consent shall not be unreasonably withheld. Failure of the Contractor to respond within ten (10) business days to a written request shall constitute consent by the Contractor.
- O. In case of the termination of the employment of the Project Manager, the Owner may appoint a successor Project Manager, whose status and duties under the Contract Documents shall be the same as those of the former Project Manager.

2.08 OWNER

- A. Information and Services Required of the Owner
 - 1. Unless otherwise provided in the Contract Documents, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for the construction, use or occupancy of permanent structures or for permanent changes in existing facilities.
 - 2. Information or services under the Owner's control shall be furnished by the Owner with reasonable promptness to avoid delay in the orderly progress of the Work.
 - 3. The Owner shall forward all instructions to the Contractor through the Project Manager.

B. Owner's Right to Stop the Work

If the Contractor fails to correct defective work as required by Section 2.42 herein or persistently fails to carry out the Work in accordance with the Contract Documents, the Owner, by a written order signed personally or by an agent specifically so empowered by the Owner in writing, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the Owner to stop the Work shall not give rise to any duty on the part of the Owner to exercise this right for the benefit of any contractor or any other person or entity, except to the extent required by Section 2.12.C.

C. Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, and fails after written notice from the Owner to correct such default or neglect with diligence and promptness, the Owner may, after an additional written notice and without prejudice to any other remedy the Owner may have, make good such deficiencies. In such case an appropriate Contract Change Order shall be issued deducting from the payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the additional services of the Architect or other professionals made necessary by such default, neglect or failure. Such action by the Owner and the amount charged to the Contractor are both subject to the prior approval of the Architect. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner, or Owner may require payment by the surety on the performance or warranty bonds as appropriate. Such action shall, in no way, affect the status of either party under contract, nor be held as a basis of any claim by the Contractor for damages or extension of time.

2.09 CONTRACTOR RESPONSIBILITIES

A. Review of Contract Documents and Field Conditions

1. The Contractor shall carefully study and compare the Contract Documents and shall at once report to the Project Manager any discrepancy or inconsistency that may be discovered. The Contractor shall not be liable to the Owner or the Project Manager for any damage resulting from any such inconsistencies or discrepancies in the Contract Documents unless the Contractor recognized such inconsistencies or discrepancies and knowingly failed to report it to the Project Manager. The Contractor shall perform no portion of the Work at any time unless authorized by the Contract Documents or, where required, approved Shop Drawings, Product Data or Samples for such portion of the Work.

2. Neither the Owner nor the Project Manager or Architect assume any responsibility for an understanding or representation made by any of their agents or representation prior to the execution of the Agreement unless (1) such understanding or representations are expressly stated in the Agreement, and (2) the Agreement expressly provides that responsibility therefor is assumed by the Owner.
3. Failure by the Contractor to acquaint himself/herself with all available information will not relieve him/her from responsibility for estimating properly the difficulty or cost of successfully performing the Work.
4. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Any inconsistencies or discrepancies discovered by the Contractor shall be reported to the Project Manager at once.
5. Before submitting any Request for Information (RFI), or other contractor-initiated request for information, the Contractor shall determine that the information requested is not clearly provided in the Contract Documents. RFI's shall be submitted to the Project Manager only from the Contractor, or Owner, and not from any subcontractor, supplier or other vendor, and shall be on a form approved by the Project Manager. The Contractor shall provide a revised and updated RFI Priority Schedule on a weekly basis. The RFI Priority Schedule shall rank RFI's in order of priority and include a brief statement of reason for priority. Owner initiated RFI's will not be listed on the Contractor's RFI Priority Schedule. The Owner will provide the Architect a separate list of Owner initiated RFI's upon request of the Architect. The Architect will endeavor to respect the order of priorities as requested by the Contractor or Owner for the overall benefit of the Project. The RFI process is for information and clarification only and may not be utilized to obtain approval for changes in Work Order Price or time. Also see Division 01 - General Requirements.

B. Supervision Procedures

1. The Contractor shall efficiently supervise and direct the Work, using therein the Contractor's best skill and diligence for which he/she is remunerated in the Contract Price. The Contractor shall carefully inspect the site and study and compare the Contract Documents, as ignorance of any phase of any of the features or conditions affecting the Contract will not excuse him/her from carrying out its provisions to its full intent.

2. The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during the progress of the Work. The superintendent shall represent the Contractor and all communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be so confirmed upon written request in each case. The Superintendent who begins the Project shall remain on the Project until the Project is completed, as long as the Contractor employs that person. The Superintendent shall not be replaced without the approval of the Owner.
3. The Contractor shall be responsible to the Owner for the acts and omissions of his/her employees, subcontractors and their agents and employees, and other persons performing any of the Work under a contract with the Contractor.
4. The Contractor shall at all times enforce strict discipline and good order among his/her employees and shall not employ on the Work any unfit person or anyone not skilled in the task assigned to him/her.
5. The Contractor shall not be relieved from his/her obligations to perform the Work in accordance with the Contract Documents either by the activities or duties of the Owner or the Architect in his/her administration of the Contract, or by inspections, tests or approvals required or performed by persons other than the Contractor.
6. Contractor shall alert and inform their employees that State law requires that the identities of inmates/wards/patients/clients be kept confidential. Revealing the identities of inmates/wards/patients/clients is punishable by law.

C. Construction Procedures

1. Means and Methods – The Contractor shall be solely responsible for and control of construction means, methods, techniques, sequences, coordination and procedures for all the Work of this contract. Additionally, the Contractor shall be responsible for safety precautions and programs in connection with the Work.
2. Laws of County and State – The Contractor must comply with all laws, rules, regulations, provisions and ordinances of the County in which the Work is being done, and all State laws pertaining to the Work.
3. Safeguards – The Contractor shall provide, in conformity with all local codes and ordinances and as may be required, such temporary walls, fences, guard-rails, barricades, lights, danger signs, enclosures, etc., and shall maintain such safeguards until all work is completed.

4. Housekeeping – Contractor shall keep the premises free of excess accumulated debris. Clean up as required and as directed by the Project Manager. At completion of work all debris shall be removed from the site. Refer to General Requirements for additional requirements.
5. Labor and Materials – Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.
6. The Contractor shall deliver to the Project Manager, prior to final acceptance of the Work as a whole, signed certificates from suppliers of materials and manufactured items stating that such items conform to the Contract Documents.
7. The Contractor, immediately upon receipt of the Notice to Proceed (or where shop drawings, samples, etc., are required, immediately upon receipt of review thereof), shall place orders for all materials, work fabrication, and/or equipment to be employed by him/her in connection with that portion of the contracted Work. The Contractor shall keep all materials, work fabrications and/or equipment specified and shall advise the Project Manager promptly, in writing, of all orders placed and of such materials, work fabrications and/or equipment which may not be available in a timely manner for the purposes of the Contract.
8. Any worker whose work is unsatisfactory to the Owner or the Architect, or are considered by the Owner or Architect to be careless, incompetent, unskilled or otherwise unfit shall be dismissed from work under the Contract upon written request to the Contractor from the Owner or the Architect.
9. Temporary Facilities – Contractor may connect to existing water and electricity available on the site provided it is suitable to the Contractor's requirements. Water and electricity used will be paid by the Owner. Contractor shall bear all expenses for carrying the water or electricity to the appropriate locations and to connect or tap into existing lines. Toilet facilities may be available on a site to the workmen engaged in the performance of this contract. It shall be the responsibility of the Contractor to confirm with the Owner the availability of toilet facilities on the site. The use of such facilities may be revoked in the event of excess janitorial requirements.
10. Contractor shall not perform any fire hazardous operation adjacent to combustible materials. Any fire hazardous operation shall have proper fire extinguisher close by and the adjacent area shall be policed before stopping work for the day. Contractor shall provide not less than one OSHA/NFPA Class 6-ABC fire extinguisher for each 9,000 square feet of Project area or fraction thereof.

11. Contractor shall erect temporary dust separation partitions and floor mats as necessary to confine dust and debris within area of work. Contractor shall post signs, erect and maintain barriers and warning devices for the protection of the general public and Owner personnel.
12. Trenching and Excavation – In accordance with Section 7104 of the California Public Contract Code, the following provisions shall apply to any contract involving digging of trenches or other excavations that extend deeper than four feet below the surface:
 - a. The Contractor shall promptly, and before the following conditions are disturbed, notify the Owner, in writing, of any:
 - i. Material that the contractor believes may be material that is hazardous waste, as defined in Section 25117 of the Health and Safety Code that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.
 - ii. Subsurface or latent physical conditions at the Project site differing from those indicated by information about the site made available to bidders prior to the deadline for submitting bids.
 - iii. Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the contract.
 - b. The Owner shall promptly investigate the conditions, and if it finds that the conditions do materially so differ, or do involve hazardous waste, and cause a decrease or increase in the contractor's cost of, or the time required for, performance of any part of the work, shall issue a Contract Change Order in accordance with the provisions of Section 2.09 of the General Conditions.
 - c. In the event that a dispute arises between the Owner and the contractor whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in the contractor's cost of, or time required for, performance of any part of the work, the contractor shall not be excused from any scheduled completion date provided for by the contract, but shall proceed with all work to be performed under the contract. The contractor shall retain any and all rights provided either by contract or by law which pertain to the resolution of disputes and protests between the contracting parties.

2.10 SUBCONTRACTORS

- A. Agreements – Agreements between the Contractor, Subcontractors, and Subcontractors of lower tier shall be subject to the approval of the Owner, but in no case does such approval relieve the Contractor of any conditions imposed by the Contract Documents. The Contractor shall only use those subcontractors that are required to be listed and included in his/her sealed bid Subcontractor List, section 004336, unless any proposed substitution is first approved by the Owner pursuant to statute. The Contractor shall not use any subcontractor who is ineligible to perform work on a Public Works Project pursuant to section 1777.1 or 1777.7 of the Labor Code. Notwithstanding any other provision of the Contract Documents, subcontractors may be added, deleted or substituted only in accordance with the provisions of Public Contract Code Section 4100 et seq.
- B. Relation with Subcontractor – By an appropriate agreement, written where legally required for enforceability, the Contractor shall bind every Subcontractor and require therein that every Subcontractor agrees to be bound by the terms of the Contract Documents to carry out their provisions insofar as applicable to their work; and the Contractor further agrees to pay to each Subcontractor promptly upon issuance of Certificate of Payment, his/her or their due portion. Said agreement shall preserve and protect the rights of the Owner and the Architect under the Contract Documents with respect to the work to be performed by the Subcontractor so that the subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the Contractor-Subcontractor Agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, under the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with their Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the Subcontract, copies of the Contract Documents to which the Subcontractor will be bound by this Paragraph and identify to the Subcontractor any terms and conditions of the proposed Subcontract which may be at variance with the Contract Documents. Each Subcontractor shall similarly make copies of Contract Documents available to their Sub-subcontractors. Nothing contained herein shall be deemed to create an agency relationship between the Owner and any Subcontractor or material supplier.
- C. Owner's Relation – Neither the acceptance of the name of Subcontractor nor the suggestion of such name nor any other act of the Owner or Architect nor anything contained in any Contract Document is to be construed as creating any contractual relation between the Owner (or Owner's authorized representatives) and any Subcontractor of any tier nor as creating any contractual relation between the Architect and any Subcontractor of any tier.
- D. All Subcontractors employed by the Contractor shall be appropriately licensed in conformity with the laws of the State of California.

- E. Jurisdictional disputes between Subcontractors or between Contractor and Subcontractor shall not be mediated or decided by the Owner, Architect or the Architect. The Contractor shall be responsible for the resolution of all such disputes based upon his/her contractual relationship with his/her Subcontractors.

2.11 OWNER'S RIGHT TO PERFORM WORK AND TO AWARD SEPARATE CONTRACTS

- A. The Owner reserves the right to perform work related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other work on the site under these or similar Conditions of the Contract. If the Contractor claims that the Owner's action results in delay, damage or additional cost attributable thereto, the Contractor shall make such claim as provided elsewhere in the Contract Documents.
- B. When separate contracts are awarded for different portions of the Project or other work on the site, the term Contractor in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.
- C. The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.
- D. Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights which apply to the Contractor under the Conditions of the Contract.

2.12 MUTUAL RESPONSIBILITY

- A. The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

- B. When any part of the Contractor's Work depends upon proper execution or results of the work of the Owner or any separate contractor, the Contractor shall, prior to proceeding with the Work, promptly report to the Project Manager any apparent discrepancies or defects in such other work that render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acceptance of the Owner's or separate contractor's work as fit and proper to receive the Work, except as to defects which may subsequently become apparent in such work by others.
- C. If, following the reporting of any discrepancy or defect as required herein above, the Contractor suffers damage due to disruption or delay caused by the separate contractor, without fault by the Owner, the Contractor's remedy shall be limited to seeking recovery from the separate contractor.
- D. Any costs caused by defective or ill-timed work shall be borne by the Contractor responsible therefor.
- E. Should the Contractor cause damage to the work or property of the Owner, or to other work or property on the site, the Contractor shall promptly remedy such damage as provided herein.
- F. Should the Contractor wrongfully delay or cause damage to the work or property of any separate contractor, the Contractor shall, upon due notice, promptly attempt to settle with such other contractor by agreement, or otherwise to resolve the dispute. If such separate contractor sues the Owner on account of any delay or damage alleged to have been caused by the Contractor, the Owner shall notify the Contractor who shall defend such proceedings, and if any judgment or award against the Owner (or Owner's authorized representatives) arises therefrom, the Contractor shall pay or satisfy such judgment or award in full and shall reimburse the Owner for all costs which the Owner has incurred in connection with such matter.

2.13 OWNER'S RIGHT TO CLEAN UP

If a dispute arises between the Contractor and separate contractors as to their responsibility for cleaning up as required in the Contract Documents, the Owner may clean up and the contractor responsible shall pay Owner such portions of the cost as the Project Manager shall determine to be just.

2.14 GOVERNING LAW

The Contract shall be governed by the law of the State of California.

2.15 INSPECTION

- A. All material and workmanship (if not otherwise designated by the Contract Documents) shall be subject to inspection, examination, and test by the Owner and Project Manager at any and all times during manufacture and/or construction and at any and all places where such manufacture and/or construction are carried on. The Owner and Project Manager shall have the right to reject defective material and workmanship or require its correction.
- B. The Contractor shall furnish promptly without additional charge, all reasonable facilities, labor, and materials necessary for the safe and convenient inspection and tests that may be required by the Owner and Project Manager.
- C. Where the Contract Documents, instructions by the Owner, laws, ordinances, or any public authority having jurisdiction requires work to be inspected, tested or approved before work proceeds, such work shall not proceed, nor shall it be concealed prior to inspection.
- D. The Contractor shall give the Project Manager at least two (2) business days advance notice of the readiness for any Contract compliance inspection by the Inspector. The Contractor shall give notice as required by all other inspecting and testing agencies of jurisdiction for Code and regular compliance inspection. In all cases, the Contractor shall schedule inspections so as not to delay the Work.
- E. If the Project Manager determines that any work requires additional special inspection beyond that identified in the specifications, the Project Manager will, upon written authorization from the Owner, instruct the Contractor to order such special inspection, testing or approval, and the Contractor shall give notice as provided above. If such special inspection or testing reveals a failure of the Work to comply with the requirements of the Contract Documents, the Contractor shall bear all costs thereof, including compensation for the Project Manager's additional services, testing or inspections made necessary by such failure; otherwise the Owner shall bear such costs, and an appropriate Contract Change Order shall be issued.
- F. Should it be considered necessary or advisable by the Project Manager at any time either before acceptance of the entire Work or after acceptance and within the guaranty period to make an examination of work already completed, by removing or tearing out same, the Contractor shall on request promptly furnish all necessary facilities, labor, and material. If such work is found to be defective in any material respect, due to the fault of the Project Manager or his/her Subcontractors, he/she shall defray all the expenses of such examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the contract, any compensation deemed appropriate shall be handled by issuance of a Contract Change Order to the Contractor and he/she shall, in addition, if completion of the work has been delayed thereby, be granted a suitable extension of time on account of the additional work involved.
- G. Required certificates of inspection, testing or approval shall be secured by the Contractor and the Contractor shall promptly deliver them to the Project Manager for review and evaluation of compliance with the appropriate specifications and standards.

- H. When the work is completed the Contractor shall notify the Project Manager in writing that the work will be ready for final inspection and test on a definite date which shall be stated in such notice.

2.16 TAXES, PERMITS, FEES, AND INDEMNIFICATION FOR PATENT INFRINGEMENT CLAIM

- A. The Contractor shall pay for and include all Federal, State and local taxes direct or indirect for the work or portions thereof provided by the Contractor which are legally enacted at the time the Notice to Proceed is issued, whether or not yet enacted, and secure and pay all fees and charges for permits and licenses, unless otherwise specified.
- B. Royalty and license fees incidental to the use of any patented material, device or process shall be paid by the Contractor and in the event of a claim of alleged infringement of patent copyright, or Trade Secret rights, the Contractor shall indemnify, save the Owner (and Owner's authorized representatives) free and harmless, and defend, at the Contractor's own expense, any and all suits that may be brought in such connection.
- C. Unless otherwise provided in the Contract Documents, the Owner shall secure and pay for the building permit, permanent utility connection fees, and right-of-way encroachment permit. The Contractor shall secure and pay for temporary construction utilities, and all other permits and governmental fees, licenses and inspections necessary for the proper execution and completion of the Work.
- D. The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the performance of the Work.
- E. It is not the responsibility of the Contractor to make certain that the Contract Documents are in accordance with applicable laws, statutes, building codes and regulations. If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, the Contractor shall promptly notify the Project Manager in writing, and any necessary changes shall be accomplished by appropriate Modification.
- F. If the Contractor performs any work knowing it to be contrary to any laws, ordinances, rules and regulations, without notice to the Project Manager, the Contractor shall assume full responsibility therefor and shall bear all costs attributable thereto.
- G. Any reference in the Contract Documents to codes, standard specifications or manufacturer's instructions shall mean the latest printed edition of each in effect at the Contract date.

2.17 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Within thirty (30) calendar days after receipt of Notice to Proceed, the Contractor shall submit a Construction Schedule in CPM (Critical Path Method) form to the Project Manager for approval. The Construction Schedule shall be sufficiently detailed to accurately depict all the work required by the Contract. CPM Construction Schedule shall reflect shop drawings; submittals due and return dates, fabrication and delivery times, cost loading, crew mix, and equipment loading data. The Contractor shall thereafter adhere to the Construction Schedule, as updated monthly, or as necessary in accordance with the Contract Documents, including any scope changes or changes in the work approved by the Owner during the course of construction. "Slack" or "float" time on the CPM Construction Schedule is not intended, and shall not be, for the sole benefit of either the Owner or Contractor.
- B. Within fourteen (14) calendar days after the pre-construction conference, the Contractor shall provide a Submittal and Procurement Schedule indicating time periods for review of Shop Drawings, Data, Samples, and procurement of material and equipment required for the Work. Contractor shall allow time for submittal review in accordance with the General Requirements Section – Construction Progress Documentation. All items that require review by the Project Manager and/or are not readily available from stock and requiring more than thirty-five (35) days lead-time shall be included in the Submittal and Procurement Schedule. Items listed in the Submittal and Procurement Schedule shall also be identified as activities on the CPM Construction Schedule. Contractor shall identify items requiring coordination with work of separate contractors. The working day to calendar date correlation shall be based upon the Contractor's proposed work week with adequate allowance for legal holidays, days lost due to abnormal weather, and any special requirements of the Project.
- C. The Construction Schedule shall be prepared and maintained by the Contractor.
- D. The Owner, Project Manager, Contractor and other Contractor(s) shall jointly review the progress of the work weekly. Should this review, in the opinion of the Project Manager, indicate that the work is behind the schedule established by currently reviewed Construction Schedule, the Contractor shall either (1) provide a plan to the Project Manager indicating the steps the Contractor intends to take in order to recover the time behind schedule and conform to the reviewed Construction Schedule; or (2) submit a revised Construction Schedule for completion of the work, remaining within the contract completion time, to the Project Manager for review by the next weekly meeting. If the Contractor's recovery or revised schedule requires work to occur during other than normal working hours, the Contractor will be responsible for any resulting costs incurred by the Owner, including but not limited to, the costs for construction management, contract administration, inspection, testing and staffing.

- E. The Contractor shall deliver copies of his/her daily job logs to the Project Manager and Owner on a weekly basis or as otherwise agreed to by Owner. At a minimum, the Contractor's daily job log should include the sub-contractors working onsite, number of workers and their trade classification, description of work, visitors, temperature and weather conditions, accidents, delays, and any other important information pertaining to the Project that day. The Contractor will schedule and coordinate the Work of all sub-contractors on the Project. The Contractor will keep the Sub-contractors informed of the Construction Schedule to enable the Contractor to plan and perform the Work properly.

2.18 RECORDS, DOCUMENTS AND SAMPLES AT THE SITE

- A. The Contractor shall maintain all records of required Review Agencies, County or State inspections and shall promptly notify the Project Manager of the results of any inspection. Copies of all such records shall be provided to the Owner.
- B. The Contractor shall secure and maintain required certificates of inspection, testing or approval and shall promptly deliver them to the Project Manager.
- C. The Contractor shall maintain at the Project site, on a daily basis, one (1) record copy of all Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record all changes made during construction, and reviewed Shop Drawings, Product Data and Samples. These shall be available to the Project Manager and the Owner and reviewed weekly, and shall be delivered to the Project Manager for forwarding to the Owner upon completion of the Project. The Contractor shall advise the Project Manager on a current basis of all changes in the Work made during construction. Payment may be withheld from Contractor for failure to maintain current Record Documents.

2.19 USE OF SITE

- A. The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents, and shall not unreasonably encumber the site with any materials or equipment.
- B. The Contractor shall coordinate all of the Contractor's operations with, and secure approval from, the Project Manager before using any portion of the site. Also see Technical Specifications, Division 01, General Requirements.

2.20 CUTTING AND PATCHING OF WORK

- A. The Contractor shall be responsible for all cutting, fitting or patching that may be required to complete the Work or to make its several parts fit together properly.

- B. The Contractor shall not damage or endanger any portion of the Work or the work of the Owner or any separate contractors by cutting, patching or otherwise altering any work, or by excavation. The Contractor shall not cut or otherwise alter the work of the Owner or any separate contractor except with the written consent of the Owner and of such separate contractor. The Contractor shall not unreasonably withhold from the Owner or any separate contractor consent to cutting or otherwise altering the Work.
- C. The Contractor in all cases shall exercise extreme care in any cutting operations, and perform such operations under adequate supervision by competent mechanics skilled in the applicable trade. Openings shall be neatly cut and shall be kept as small as possible to avoid unnecessary damage. Careless and/or avoidable cutting damage, etc., will not be tolerated, and the Contractor will be held responsible for such avoidable or willful damage.
- D. All replacing, patching and repairing of all materials and surfaces cut or damaged in the execution of the Work shall be performed by experienced mechanics of the several trades involved. All work of such nature shall be done with the applicable materials, in such a manner that all surfaces so replaced, repaired, or patched, will, upon completion of the Work, match the surrounding similar surfaces.

2.21 CLEANING UP

- A. The Contractor shall at all times keep the premises free from accumulation of waste materials or rubbish caused by the Contractor's operations. At the completion of the Work, the Contractor shall remove all the Contractor's waste materials and rubbish from and about the Project as well as all the Contractor's tools, construction equipment, machinery and surplus materials.
- B. If the Contractor fails to clean up at the completion of the Work, the Owner may do so, and the cost thereof shall be paid by the Contractor.

2.22 INDEMNIFICATION

- A. To the fullest extent permitted by law, Contractor agrees to and shall indemnify, save, hold harmless and at Owner's request, defend Owner and its officers, agents and employees, and the Architect and Consultants and their respective officers, agents and employees, from any and all costs and expenses, attorney fees and court costs, damages, liabilities, claims and losses occurring or resulting to Owner, the Architect or Consultants in connection with the performance, or failure to perform, by Contractor, its officers, agents or employees under this Agreement, and from any and all costs and expenses, attorney fees and court costs, damages, liabilities, claims and losses occurring or resulting to any person, firm or corporation who may be injured or damaged by the performance, or failure to perform, of Contractor, its officers, agents or employees under this Agreement. In addition, Contractor agrees to indemnify Owner for Federal, State of California and/or local audit exceptions resulting from non-compliance herein on the part of Contractor.

- B. In any and all claims against the Owner, the Architect or Consultants, or any of their respective officers, agents or employees, initiated by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation set forth in the immediately preceding paragraph shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under workmen's compensation acts, disability benefit acts or other employee benefit acts.

2.23 FAIR EMPLOYMENT PRACTICES CLAUSE

Nondiscrimination: In connection with the performance of Work under the contract, the Contractor agrees (as prescribed in Chapter 6 of Division 3 of Title II of the Government Code of the State of California, commencing at Section 12900 and by Labor Code Section 1735) not to discriminate against any employee or applicant for employment because of race, religious creed, color, national origin, ancestry, physical disability, mental disability, medical condition, marital status or sex. The aforesaid provisions shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. The Contractor agrees to post hereafter in conspicuous places, available for employees and applicants for employment, Notices to be provided by the County, setting forth the provisions of this discrimination clause. The Contractor further agrees to insert the foregoing provisions in all subcontracts hereunder, except subcontracts for standard commercial supplies of raw materials.

2.24 PAYMENT

A. CONTRACT SUM

The Contract Sum is stated in the Owner-Contractor Agreement ("the Agreement"), Section 005213, and, including authorized adjustments thereto, is the total amount payable by the Owner to the Contractor for the performance of the Work under the Contract Documents.

B. SCHEDULE OF VALUES

Before the first Application for Payment, the Contractor shall submit to the Project Manager a Schedule of Values allocated to the various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Project Manager may require. This schedule, unless objected to by the Project Manager, shall be used only as a basis for the Contractor's Applications for Payment.

C. APPLICATIONS FOR PAYMENT

The Owner will make progress payments to the Contractor upon completion of portions of the Work, as covered by the Contract Documents, in accordance with established Owner procedures. Before submitting an Application for Payment (Final or Partial) the Contractor shall reach an agreement with the Project Manager (in consultation with the Architect) concerning the percentage complete of the Work and the dollar value for which the Application for Payment may be submitted.

1. On or about the twentieth (20th) day of the month in which the work was performed, the Contractor shall submit to the Project Manager an itemized Application for Payment, notarized if required, supported by such data substantiating the Contractor's right to payment as the Owner or the Project Manager may require, including appropriate updates to the Construction Schedule, and reflecting retainage, if any, as provided elsewhere in the Contract Documents. Payment is expressly conditioned upon submission by the Contractor of conditional and unconditional waivers and release of lien rights upon progress payment as the Owner or the Architect may require. Waiver and Release forms must be submitted on forms approved by the Owner. Copies of said forms shall comply with Civil Code Section 8132 through 8138, inclusive.
2. Unless otherwise provided in the Contract Documents, payments may be made on account of materials or equipment not incorporated in the Work but delivered and suitably stored at the site and, if approved in advance by the Owner, payments may similarly be made for materials or equipment suitably stored at some other location agreed upon in writing. Payments for materials or equipment stored on or off the site shall be conditioned upon submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials or equipment or otherwise protect the Owner's interest, including applicable insurance and transportation to the site for those materials and equipment stored off the site.
3. The Contractor warrants that title to all work, materials and equipment covered by an Application for Payment will pass to the Owner either by incorporation in the construction or upon receipt of payment by the Contractor, whichever occurs first, free and clear of all liens, stop notices, claims, security interest or encumbrances, hereinafter referred to as "liens"; and that no work, materials or equipment covered by an Application for Payment will have been acquired by the Contractor, or by any other person performing work at the site or furnishing materials and equipment for the Project, subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or such other person.
4. On or about the twentieth (20th) day of the month following the month in which the work was performed, the Owner shall pay to the Contractor ninety-five percent (95%) of the value of said work in place, as checked and approved by the Project Manager. The balance of five percent (5%) of the estimate shall be retained by the Owner until the time of

final acceptance of said work. In lieu of the five percent (5%) retainage, the Contractor may substitute securities as provided herein below.

- a. If the Owner does not pay the Contractor within thirty (30) days after receipt of an undisputed and properly submitted payment request for a progress payment, excluding that portion of the final payment designated by the contract as retention earnings, then the Owner shall pay interest to the Contractor as provided by Public Contract Code Section 20104.50. Said interest penalty is the sole recourse of Contractor and Contractor shall have no right to stop the Work until payment of the amount owing has been received, nor shall the contract completion time be extended, nor shall the Contract Sum be increased in any way, including by reason of any costs incurred by Contractor, except to the extent of said interest payment.
 - b. Pursuant to Public Contract Code Section 7107, in the event of a dispute between the Owner and Contractor, the Owner may withhold from the final payment an amount not to exceed one hundred and fifty percent (150%) of the disputed amount. Except as so provided, the Owner shall release the retention withheld within sixty (60) days after the date of completion of the Work, as "completion" is defined in Public Contract Code Section 7107. In the event that retention payments are not made within the time periods required by Public Contract Code Section 7107, the Owner may be subject to the interest provisions of Public Contract Code Section 7107.
5. Security Substitutions and Escrow for Moneys Withheld to Insure Contractor's Performance. Pursuant to Public Contract Code section 22300, the Contractor may deposit in an escrow, equivalent securities for any moneys withheld to ensure performance and have said moneys paid directly to Contractor, or, in the alternative, have the Owner deposit such moneys directly into an escrow. Upon the closing of any such escrow, Contractor shall pay to each Subcontractor, not later than twenty (20) days after receipt of the closing payment, the respective amount of interest earned, net of costs attributed to retention withheld from each Subcontractor, on the amount of retention withheld to insure the performance of the Contractor. Any escrow established pursuant to this article shall be with a state or federally chartered bank, shall be at the sole expense of the Contractor, and shall be established using an escrow agreement in substantially the following form:

(Begin Escrow Agreement)

ESCROW AGREEMENT FOR SECURITY DEPOSITS IN LIEU OF RETENTION

This Escrow Agreement is made and entered into by and between the County of Fresno, (hereinafter called "Owner"), _____, (hereinafter called _____ "Contractor"); and _____, a state or federally chartered bank in California, (hereinafter called "Escrow Agent").

For the consideration hereinafter set forth, the Owner, Contractor, and Escrow Agent agree as follows:

1. Pursuant to Section 22300 of the Public Contract Code of the State of California, Contractor has the option to deposit securities with Escrow Agent as a substitute for retention earnings required to be withheld by Owner pursuant to the Construction Contract entered into between the Owner and Contractor for _____ in the amount of \$ _____, and dated _____ (hereinafter referred to as the "Contract"). Alternatively, on written request of the Contractor, the Owner shall make payments of the retention earnings directly to the Escrow Agent. When Contractor deposits the securities as a substitute for Contract earnings, the Escrow Agent shall notify the Owner within ten (10) days of the deposit. The market value of the securities at the time of the substitution, as valued by the Owner, shall be at least equal to the cumulative total cash amount then required to be withheld as retention under the terms of the contract between Owner and Contractor. If the Owner determines that the securities are not adequate it will notify Contractor and Escrow Agent, and Contractor shall deposit additional security as further determined by the Owner. Securities shall be held in the name of the Owner and shall designate the Contractor as the beneficial owner.
2. Securities eligible for investment under subdivision (c) of the above-referenced Section 22300 shall include those listed in Section 16430 of the Government Code, and shall also include bank or savings and loan certificates of deposit, interest-bearing demand deposit accounts, and standby letters of credit. Deposit of any other type of security may be permitted only by mutual agreement of the Contractor and the Owner, evidenced by an amendment to this agreement executed by all of the parties hereto.
3. Upon the deposit of adequate securities, Owner shall make progress payments to the Contractor for such funds which otherwise would be withheld from progress payments pursuant to the Contract provisions.
4. When the Owner, at Contractor's written request, makes payment of retentions earned directly to the Escrow Agent, the Escrow Agent shall hold them for the benefit of the Contractor until such time as the escrow created under this contract is terminated. The Contractor may direct the investment of the payments into securities. All terms and conditions of this agreement and the rights and responsibilities of the parties shall be equally applicable and binding when the Owner pays the Escrow Agent directly.

5. Contractor shall be responsible for paying all fees for the expenses incurred by Escrow Agent in administering the Escrow Account and all expenses of the Owner. The Owner, Contractor and Escrow Agent shall determine these expenses and payment terms.
6. The interest earned on the securities or the money market accounts held in escrow and all interest earned on that interest shall be for the sole account of Contractor and shall be subject to withdrawal by Contractor at any time and from time to time without notice to the Owner.
7. Contractor shall have the right to withdraw all or any part of the principal in the Escrow Account only by written notice to Escrow Agent accompanied by written authorization from Owner to the Escrow Agent that Owner consents to the withdrawal of the amount sought to be withdrawn by Contractor.
8. The Owner shall have the right to draw upon the securities or any amount paid directly to Escrow Agent in the event of default by the Contractor. Upon seven (7) days written notice to the Escrow Agent from the Owner of the default, the Escrow Agent shall immediately convert the securities to cash and shall distribute the cash, including any amounts paid directly to Escrow Agent, as instructed by the Owner. Escrow Agent shall not be concerned with the validity of any notice of default given by Owner pursuant to this paragraph, and shall promptly comply with Owner's instructions to pay over said escrowed assets. Escrow Agent further agrees not to interplead the escrowed assets in response to conflicting demands and hereby waives any present or future right of interpleader.
9. Upon receipt of written notification from the Owner certifying that the Contract is final and complete, and that the Contractor has complied with all requirements and procedures applicable to the Contract, Escrow Agent shall release to Contractor all securities and interest on deposit less escrow fees and charges of the Escrow Account. The escrow shall be closed immediately upon disbursement of all moneys and securities on deposit and payment of fees and charges.
10. Escrow Agent shall rely on the written notifications from the Owner and Contractor pursuant to Sections (6), (7), (8) and (9) of this Agreement and the Owner and Contractor shall hold Escrow Agent harmless from Escrow Agent's release and disbursement of the securities and interest as set forth above.
11. The venue of any litigation concerning the rights and obligations of the parties to this agreement shall be the County of Fresno and the parties hereto waive the removal provisions of Code of Civil Procedure Section 394.
12. The names of the persons who are authorized to give written notice or to receive written notice on behalf of the Owner and on behalf of Contractor in connection with the foregoing, and exemplars of their respective signatures are as follows:

On Behalf of Owner:

Title – **Business Manager**

Name – **Lemuel Asprec**

Signature _____

Address: **2220 Tulare St, 6th Floor
Fresno, CA 93721**

On behalf of Contractor:

Title

Name

Signature _____

Address:

On behalf of Escrow Agent:

Title

Name

Signature

Address

At the time the Escrow Account is opened, the Owner and Contractor shall deliver to the Escrow Agent a fully executed counterpart of this Agreement

IN WITNESS WHEREOF, the parties have executed this Agreement by their proper officers on the date first set forth above.

Owner:

Title – **Steve White, Director
Department of Public Works
and Planning**

Signature _____

Address – **2220 Tulare St, 6th Floor
Fresno, CA 93721**

Contractor:

Title

Name

Signature _____

Address

Escrow Agent:

Title

Name

Signature

Address

(End Escrow Agreement)

6. Itemized Breakdown: The Contractor shall submit a financial breakdown of the work, itemized by crafts or sections as designated by the Owner. The Contractor's payment shall be based upon the monthly percentage of completion of these items.
7. Lien Waivers: The Owner may require the Contractor to submit, along with the progress payment request, notarized lien waivers from each Subcontractor, materials or equipment supplier. Lien waivers shall comply with Civil Code Section 8132, et seq., and the aggregate sum thereof shall reflect all progress payments previously made.

D. CERTIFICATES FOR PAYMENT

1. The Project Manager shall, within seven (7) days after the receipt of the Project Application for Payment, review the Project Application for Payment and either issue a Project Certificate for Payment to the Owner for such amounts as the Project Manager determines are properly due, or notify the Contractor in writing of the reasons for withholding a Certificate provided in Part F of this Section 2.24.
2. The issuance of a Project Certificate for Payment will constitute a representation by the Project Manager to the Owner that, based on the Project Manager's observations at the site as provided herein and the data comprising the Project Application for Payment, the Work has progressed to the point indicated and that, to the best of the Project Manager's knowledge, information and belief, the quality and timeliness of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work for conformance with the Contract Documents upon Completion of the Work, to the results of any subsequent tests required by or performed under the Contract Documents, to minor deviations from the Contract Documents correctable prior to completion, and to any specific qualifications stated in the Certificate); and that based upon all currently available information, the Contractor is entitled to payment in the amount certified. However, by issuing a Project Certificate for Payment, the Project Manager shall not thereby be deemed to represent that the Project Manager has made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, has reviewed the construction means, methods, techniques, sequences or procedures, or has made any examination to ascertain how or for what purpose the Contractor has used the monies previously paid on account of the Contract Sum.

E. PROGRESS PAYMENTS

1. After the Project Manager has issued a Project Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents.

2. The Contractor shall promptly pay each Subcontractor upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's Work, the amount to which Subcontractor is entitled, reflecting the percentage actually retained, if any, from payments to the Contract on account of such Subcontractor's Work. The Contractor shall, by an appropriate agreement with each Subcontractor, require each Subcontractor to make payments to their Sub-subcontractors in similar manner.
3. The Project Manager may on request of any Subcontractor, at the Project Manager's discretion, furnish to that Subcontractor, if practicable, information regarding the percentages of completion or the amounts applied for by the Contractor and the action taken thereon by the Project Manager on account of Work done by such Subcontractor.
4. Neither the Owner nor the Project Manager shall have any obligation to pay or to see to the payment of any monies to any Subcontractor or Material Suppliers except as may otherwise be required by law.
5. Neither certification of a progress payment, delivery of a progress payment, nor partial or entire use or occupancy of the Project by the Owner, shall constitute an acceptance of any Work not performed in accordance with the Contract Documents.

F. PAYMENTS WITHHELD

1. The Project Manager may decline to certify payment and may withhold the Certificate in whole or in part to the extent necessary to reasonably protect the Owner, if, in the Project Manager's opinion, the Project Manager is unable to make representations to the Owner as provided herein above for Certificates for Payment. If the Project Manager is unable to make representations to the Owner and certify payment in the amount of the Project Application, the Project Manager will notify the Contractor as provided herein. If the Contractor and the Project Manager cannot agree on a revised amount, the Project Manager will promptly issue a Project Certificate for Payment for the amount for which the Project Manager is able to make such representations to the Owner. The Project Manager may also decline to certify payment or, because of subsequently discovered evidence or subsequent observations, the Project Manager may nullify the whole or any part of any Project Certificate for Payment previously issued to such extent as may be necessary, in the Project Manager's opinion, to protect the Owner from loss because of:
 - a. Defective Work not remedied;
 - b. Third party claims filed or reasonable evidence indicating probable filing of such claims, including claims by separate contractors;
 - c. Failure of the Contractor to make payments properly to Subcontractors, or for labor, materials or equipment;
 - d. Architect's determination, based upon reasonable evidence, that the Work cannot be completed for the unpaid balance of the Contract Sum;

- e. Damage to the Owner or another contractor;
 - f. Architect's determination, based upon reasonable evidence, that the Work will not be accomplished in compliance with the Work Order Completion Time;
 - g. Persistent failure to carry out the Work in accordance with the Contract Documents;
 - h. Failure of the Contractor to submit Construction Schedules or Submittal and Procurement Schedules as required;
 - i. Failure of the Contractor to maintain record drawings on a current basis;
 - j. Failure of the Contractor to submit notarized lien waivers from each Subcontractor, materials or equipment supplier;
 - k. Failure of the Contractor to submit certified payroll reports;
 - l. Stop notice served upon the Owner.
2. A retention in the amount of one-thousand dollars (\$1,000) will be withheld from the Contractor's monthly progress payment for each and every required document not submitted in a timely manner by the Contractor or its subcontractors up to a maximum of ten-thousand dollars (\$10,000). For purposes of this Paragraph, the term "required document" includes, but is not limited to, certified payrolls, labor compliance documents, Disadvantaged Business Enterprise documents, and any other information or documents required to be submitted by the Contractor or any of its subcontractors under the terms of this Agreement or pursuant to applicable federal, state or local laws or regulations. The retention provided for in this Paragraph shall be in addition to any other deduction or retention allowed under this Agreement, and shall be in addition to any other remedy or consequence provided by law for untimely submission of any required document. Such retention shall remain in effect only until such time as the required documents have been submitted by the Contractor or its subcontractor(s) and have been determined by the Owner to be both complete and acceptable as to form.
3. When the grounds as noted above are removed, payment shall be made for amounts withheld on the basis thereof.

G. COMPLETION AND FINAL PAYMENT

1. Following the Contractor's completion of the Work, the Contractor shall forward to the Project Manager a written notice that the Work is ready for final inspection and acceptance, and shall also forward to the Project Manager a final Application for Payment. Upon receipt, the Project Manager will promptly make such inspection. When the Project Manager finds the Work acceptable under the Contract documents and the Contract fully performed, the Project Manager will issue a Project Certificate for Payment which will certify the final payment due the Contractor. This certification will constitute a representation that, to the best of the Project Manager's knowledge, information and belief, and on the basis of observations and inspections, the Work has been completed in accordance with the Terms and Conditions of the Contract Documents and that the entire balance found to be due the Contractor, and noted in said Certificate, is due and payable. The Project Manager's certification of said Project Certificate for Payment will constitute a further representation that the conditions precedent to the Contractor's being entitled to final payment as set forth herein below have been fulfilled.
2. Neither the final payment nor the remaining retainage shall become due until the Contractor submits to the Project Manager (1) an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might in any way be responsible, have been paid or otherwise satisfied, (2) consent of surety, if any, to final payment, and (3) other data establishing payment or satisfaction of all such obligations, such as receipts, releases and waivers of liens arising out of the Contract, to the extent and in such form as may be designated by the Owner. If any Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against any such lien. The bond cannot be from the original surety insurer for the Project or any affiliate of the original surety. If any such lien remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all monies that the latter may be compelled to pay in discharging such lien.
3. All provisions of this Agreement, including without limitation those establishing obligations and procedures, shall remain in full force and effect notwithstanding the making or acceptance of final payment, and the making of final payment shall not constitute a waiver of any claims by the Owner.
4. Upon completion and acceptance of all work whatsoever required, and upon the release of all claims against the Owner as specified, the Owner shall file a written Notice of Completion with the County Recorder as to the entire amount of work performed.

5. Final payment will be released within sixty (60) days after the date of acceptance of the Work as reflected in the Notice of Completion filed with the County Recorder's Office; provided, that Owner may withhold from the final payment, in the event of a dispute between Owner and Contractor, retentions in and amount not exceeding 150 percent of the disputed amount. At the Contractor's option, the Owner may release retention upon receipt of an unconditional lien release for the full value of the Work and any of its Contract Change Orders.
6. All manufacturers' warranties required by the Contract Documents shall commence on the date of the Notice of Completion for the Work. It shall be the Contractor's responsibility, through appropriate contractual arrangements with all subcontractors, materialmen and suppliers, to ensure compliance with this requirement.
7. The acceptance by the Contractor of the final payment, after the date of Notice of Completion of the Project, shall be and shall operate as a release to the Owner of all claims and of all liability to the Contractor, under the Contract Documents or otherwise, for all things done or furnished in connection with this Work, excepting only the Contractor's claims for interest upon final payment, if such final payment be improperly delayed. No payments, however, final or otherwise, shall operate to release the Contractor or his/her sureties from any obligations under the Contract Documents, including but not limited to the Performance and Payment Bonds.

2.25 CHANGES TO THE WORK

- A. The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletion or other revisions. All such changes in the Work shall be authorized by a Contract Change Order, and shall be performed under the applicable conditions of the Contract Documents.
- B. **CONTRACT CHANGE ORDER:** A Change Order issued to add or delete Work from the Contract. Only an executed Contract Change Order will effectuate change in either the Contract Sum and/or the contract time. A Change Order is a written order to the Contractor dually signed to show both the approval of the Architect and Authorization of the Owner, issued after execution of the Contract. A Change Order signed by the Contractor indicates the Contractor's agreement therewith, including any adjustment in the Contract Sum or the contract time, and the full and final settlement of all costs (direct, indirect and overhead) related to the Work authorized by the Change Order.
- C. All claims for additional compensation to the Contractor shall be presented in writing before the expense is incurred and will be adjusted as provided herein. No work shall be allowed to lag pending such adjustment, but shall be promptly executed as directed, even if a disputed claim arises. No claim will be considered after the work in question has been done unless a Contract Change Order has been issued or a timely written notice of claim has been made by Contractor.

- D. Costs mean an itemized breakdown of all labor (by crafts), materials, sales taxes, equipment rentals, etc., for each portion of the Work which comprises the Change Order including any Subcontractor's itemized breakdown, plus not more than twenty (20) percent to cover all profits and administration.
1. Under no circumstance will the total sum of allowable mark up for General Conditions, General Requirements, supervision, overhead (excluding small tools) and profit, exceed a cumulative total of twenty percent (20%), including markups for all parties involved in a change.
 - i. Work done by Contractor's own forces, not including bond and insurance premiums, fifteen percent (15%)
 - ii. Work done by subcontractors, all tiers, including bond and insurance premiums, if any, shall not exceed a cumulative total of fifteen percent (15%)
 - iii. General Conditions, General Requirements, Supervision, Overhead and Profit for Contractor on Subcontractor's work, five percent (5%).
 2. The cost or credit to the Owner resulting from a change in the Work shall be determined in one or more of the following ways:
 - i. By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
 - ii. By unit prices state in the Contract Documents or subsequently agreed upon;
 - iii. By cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
 - iv. By the method provided under Article 2.26.
- E. The amount of credit to be allowed by the Contractor to the Owner, as confirmed by the Project Manager, for any deletion or change that results in a decrease in the Contract Sum will be the amount of the actual cost. When both additions and credits covering related Work or substitutions are involved in any one change, the allowance for overhead and profit shall be figured on the basis of the net increase, if any, with respect to that change.

2.26 CHANGES TO THE CONTRACT (EXTRA WORK AT FORCE ACCOUNT)

- A. If none of the methods set forth in Section 2.25.D, is agreed upon, the Contractor, provided that a written order signed by the Owner is received, shall promptly proceed with the Work involved. The cost of such Work shall then be determined by the Project Manager, on the basis of reasonable expenditures or savings of those performing the Work attributable to the change, including, in the case of an increase in the Contract Sum, not more than twenty percent (20%) for all overhead and profit. In such case, and also under Section 2.25.D, Paragraph 3, the Contractor shall keep and present, in such form as the Owner or the Project Manager may prescribe, an itemized accounting of actual cost together with appropriate supporting data for inclusion in a Contract Change Order. Unless otherwise provided in the Contract Documents, cost shall be limited to the following:
1. Labor Cost is the cost of labor for the workers (including working foremen) used in the actual and direct performance of the extra work, whether employed by the Contractor, or Subcontractors and Specialized Forces of any tier. Labor Cost shall include:
 - a. Actual Wages paid to the works, plus employer payments to or on behalf of the workers for health and welfare, pension, vacation, and training. If required by the Project Manager, certified payrolls shall be submitted with extra work reports as verification of wages paid to the workers.
 - b. A Labor Surcharge of 20 percent (35 percent for demolition work and roofing work) will be added to the Actual Wages as defined above. The Labor Surcharge shall constitute full compensation for all payments imposed by State and Federal laws, including Workers Compensation Insurance, Social Security, and Unemployment Insurance.
 - c. Subsistence and Travel Allowance if actually paid to the workers. Labor Surcharge will not be added to Subsistence and Travel Allowance.
 2. Equipment Cost is the payment made for the equipment actually used in the performance of the extra work.
 - a. Equipment valued at three hundred dollars (\$300) or less shall be considered as small tools, and no payment will be made therefor.
 - b. Equipment costs will be paid in accordance with the rental rates listed in the "Cal-Trans Equipment Rental Rates, County of Fresno, Department of Public Works and Planning," in effect at the time of bid, available from the Department, Suite 711, Fresno County Plaza Building, 2220 Tulare Street, Fresno, CA 93721.

- c. In the event that any of the equipment to be used is not listed in the above publication, the rental rate shall be agreed upon in writing by the Contractor and CM before the extra work is begun.
3. Materials Cost is the payment made for materials incorporated into the Work.
 - a. Materials Cost shall include sales tax, freight, and delivery charges, less any available discounts whether or not said discounts are taken.
 - b. Materials Cost shall be based upon supplier's or manufacturer's invoice. If invoices or other satisfactory evidence of cost are not furnished within sixty (60) days of delivery or within fifteen (15) days after acceptance of the Contract, whichever occurs first, then the Project Manager shall determine the Materials Cost, in his/her sole discretion, on the basis of available information and on his/her considered experience.
4. Specialized Services are those services or items of extra work that, by agreement of the Contractor and the Project Manager, cannot be performed by forces of the Contractor or his/her Subcontractors, and may be performed by a specialist.
 - a. Specialized Services may be paid for by invoice if the established practice of the specialized force industry does not provide complete itemization of Labor, Equipment and Materials Costs.
5. Markup for Profit, Home Office and Field Office Overhead, Bond Premium, insurance, taxes, and supervision will be added to the total of Labor Cost, Equipment Cost, Materials Cost, and Specialized Services.
 - a. Markup will be added only once on any Extra Work at Force Account, regardless of the number of contractors and subcontractors involved.
 - b. It is recognized that individual contractors and subcontractors have different overhead costs, profit requirements and bond premium rates. The amount to be added to Extra Work for markup shall include compensation for profit, overhead and bond premium without distinguishing among these items.
 - c. The markup to be added for Extra Work at Force Account on this Project shall be fifteen percent (15%) plus 1-1/2% for Performance and Payment Bonds for Contractor only.

6. Records shall be maintained by the Contractor and Subcontractors in such a manner as to provide a clear distinction between the costs of Extra Work paid for on a forced account basis and the costs of other operations. From these records, the Contractor shall furnish the Project Manager a completed extra work report for each day's extra work to be paid for on a force account basis. Extra work reports shall itemize the materials used, equipment rental charges, and specialized services costs, and shall provide names or identifications and classifications of workmen, the hourly rate of pay, and hours worked. Extra work reports shall be compiled and submitted to the Project Manager daily for verification and signature. Extra work reports shall be signed by the Contractor or his/her authorized representative.
7. If the Contractor disputes the Architect's cost determination, the Contractor may initiate a claim in compliance with the Claims and Disputes Resolution provisions of these General Conditions.

2.27 SITE CONDITIONS

- A. Where investigations have been conducted by the Owner of existing conditions on a site, including subsurface conditions, such investigations are made for the purpose of design only and for the information of bidders. The results of such investigations represent only the statement by the Owner as to the circumstance and character of materials actually encountered by the Owner during the investigations. The Owner makes no guarantee or warranty, express or implied, that the conditions indicated are representative of conditions existing throughout the site of a Project or any part of it, or that unanticipated conditions might not occur.
- B. All excavation work shall be performed on an "unclassified basis"; that is, such work shall include the removal of all material encountered including earth or rock formations, regardless of the type or hardness thereof, or groundwater conditions in the excavation, the cost of such excavations being included in the Contract Sum. Unclassified excavation Work includes drilling or blasting operations.
- C. If site conditions are discovered that materially differ from previous information that the Contractor has received, and that could not have been discovered by the Contractor through prudent and reasonable investigation prior to developing the Contract Sum for the Work, the Contractor shall be compensated for additional costs incurred in working with the unknown site conditions, but only to the extent that such previously unknown and undiscoverable site conditions cause the Contractor to incur costs in addition to the Contract Sum for that portion of the Work. The Contractor must be able to demonstrate clearly the original Contract Sum for that portion of the Work (plus any Contract Change Orders applicable to that portion of the Work) and the additional costs incurred as a direct result of the unknown site conditions. Only additional costs over and above the amount of the Contract Sum for that portion of the Work will be compensated upon a recommendation of approval by the Project Manager.

2.28 REQUEST FOR EQUITABLE ADJUSTMENT

- A. If the Contractor considers a Request for Equitable Adjustment is justified for any increase in the contract time, the Contractor shall promptly, upon first observance of the condition giving rise to the request, provide the Project Manager and Owner written notice of such condition and circumstance. This notice shall be given by the Contractor before proceeding to execute the Work, except in emergency endangering life or property, in which case the Contractor shall proceed in accordance with the Emergency provisions of these General Conditions. No such request shall be valid unless so made. A Contract Change Order shall be required to authorize any change in the contract time resulting from such request for equitable adjustment.
- B. If the Contractor requests that additional cost or time is involved because of, but not limited to, (1) any written interpretation pursuant to Section 2.07.G, (2) any order by the Owner to stop the Work pursuant to Section 2.08 where the Contractor was not at fault, or any such order by the Project Manager as the Owner's agent, (3) any written order for a minor change in the Work issued pursuant to Section 2.29, the Contractor shall make such request for equitable adjustment as provided in Section 2.28.A.

2.29 MINOR CHANGES IN THE WORK

The Project Manager will have authority to order minor changes in the Work not involving an adjustment in the Contract Sum or extension of the contract time and not inconsistent with the intent of the Contract Documents. Such changes shall be enacted by written order issued through the Project Manager, and shall be binding on the Owner and the Contractor. The Contractor shall carry out such written orders promptly.

2.30 SUCCESSORS AND ASSIGNS

The Owner and the Contractor, respectively, bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to the partners, successors, assigns and legal representatives of such other party with respect to all covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract or sublet it as a whole without the written consent of the other.

2.31 ASSIGNMENT OF MONEYS

The Contractor shall not assign moneys due or to become due him/her under the contract without the written consent of the Auditor-Controller of Fresno County. Any assignment of moneys shall be subject to all proper set-offs in favor of the County of Fresno and to all deductions provided for in the contract and particularly all money withheld, whether assigned or not, shall be subject to being used by the County of Fresno for the completion of the work in the event that the Contractor should be in default therein.

2.32 GUARANTEE OF WORK

- A. The Contractor warrants to the Owner that all materials and equipment and the Work as a whole furnished under this Contract will be new unless otherwise specified, and that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents, for a period of 365 Calendar Days from the date of acceptance of the Work as specified in the Notice of Completion, unless a longer period is otherwise specified. All manufacturer's warranties required by the Contract Documents shall commence on the date of the filing of the Notice of Completion for the Work (which date necessarily will follow the performance under separate contracts). It shall be the Contractor's responsibility, through appropriate contractual arrangements with all subcontractors, material men and suppliers, to ensure compliance with this requirement. All Work not conforming to these requirements, including substitutions not properly reviewed and authorized, may be considered defective. If required by the Project Manager, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.
- B. If repairs or changes are required in connection with guaranteed work within any guaranteed period, which, in the opinion of the Project Manager is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the Contract Documents, the Contractor shall, promptly upon receipt of notice from the Owner, and without expense to the Owner (1) place in satisfactory condition in every particular all of such guaranteed work, correct all defects therein, and (2) make good all damage to the building or site, or equipment or contents thereof, which, in the opinion of the Project Manager, is the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the Contract Documents; and (3) make good any work or materials, or the equipment and contents of said building or site disturbed in fulfilling any such guarantee.
- C. If the Contractor disturbs any work guaranteed under another contract in fulfilling the requirements of the contract or of any guarantee, embraced in or required thereby, he/she shall restore such disturbed work to a condition satisfactory to the Project Manager and guarantee such restored work to the same extent as it was guaranteed under such other contract.
- D. The Owner may have the defects corrected if the Contractor, after notice, fails to proceed promptly to comply with the terms of the guarantee and the Contractor and his/her surety shall be liable for all costs and expenses incurred in connection therewith.

- E. All special guarantees applicable to definite parts of the work that may be stipulated in the Contract Documents shall be subject to the terms of this Article 2.32 during the first (1st) year (365 Calendar Days) of the life of such special guarantee.

2.33 RESPONSIBILITY FOR DAMAGE

- A. Neither the Owner, the Architect, nor any officer or employee of the County, or officer or employee thereof, within the limits of which the work is being performed, shall be answerable or accountable in any manner, for any loss or damage that may happen to the work or any part thereof; or for any of the materials or other things used or employed in performing the work; or for injury to any person or persons, either workmen or the public, for damage to property from any cause which might have been prevented by the Contractor, or his/her workmen, or anyone employed by him/her, against all of which injuries or damages to persons and property the Contractor having control over such work must properly guard.
- B. The Contractor shall be responsible for any liability imposed by law for any damage to any person or property resulting from defects or obstructions or from any cause whatsoever during the progress of the work or at any time before the issuance of the Notice of Completion.
- C. The Contractor shall indemnify and hold harmless the Owner, the Project Manager, the Architect, and all of their respective officers and employees, from all claims, lawsuits or actions of every kind and nature whatsoever, brought for, or on account of any injuries or damages received or sustained by any person or persons, resulting from any act or admission by the Contractor or his/her servants or agents, in the construction of the work or by or in consequence of any negligence in guarding the same, in improper materials used in its construction, or by or on account of any act or omission of the Contractor or his/her agents in the performance of Contractor's obligations under the Contract Documents. In addition to any remedy authorized by law, so much of the money due the Contractor under and by virtue of the contract as shall be considered necessary by the Owner may be retained by the Owner until disposition has been made of such claims, lawsuits or actions for damages as aforesaid.

2.34 WRITTEN NOTICE

Subject to any additional requirements that may be applicable to claims under the immediately following Article 2.35 RESOLUTION OF CONTRACT CLAIMS AND DISPUTES, formal service, when required, of written notice shall be deemed to have been duly served if delivered in person, to the individual or member of the firm or entity or to an officer of the corporation for whom it was intended, or if sent by registered or certified mail to the listed address of that entity for the attention of such individual.

2.35 RESOLUTION OF CONTRACT CLAIMS AND DISPUTES

- A. A Claim is a demand or assertion sent by registered mail or certified mail with return receipt requested by one (1) of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time, or a request for equitable adjustment or Contract Change Order which cannot be resolved per provisions of Section 2.25 - CHANGES TO THE WORK. Any Claim shall be reduced to writing and filed with the Project Manager, within ten (10) calendar days after the Contractor has notice of the condition giving rise to the Claim, and final action per Section 2.25 - CHANGES TO THE WORK procedures has taken place or has been declared as such in writing, by either party. Such ten (10)-day notice of an asserted claim is in addition to the requirement for prompt notice required per Section 2.25 - CHANGES TO THE WORK.
- B. The Contractor shall not claim or recover any overhead cost administrative or otherwise, particularly 'Home Office' expenses, 'Extended site overhead', or any other overhead cost on the basis of any 'Home Office' damages formula, 'Eichleay' formula, 'Total Cost' recovery formula or any other such formula.
- C. REQUIREMENTS FOR FILING A CLAIM. Claims shall be submitted to the Project Manager. Claims must be filed within the time specified above, but in no event shall any claim be considered by the Project Manager that is filed later than the date of final payment of the Project. The claim shall be in writing and shall be a sum certain if known. If unknown, Contractor shall specify the basis for establishing the sum certain. Claim shall include a statement of the reasons for the asserted entitlement, and include the documents necessary to substantiate the claim. Such documents may include but are not limited to payroll records, purchase orders, quotations, invoices, estimates, subcontracts, daily logs, supplier contracts, subcontract billings, bid takeoffs, equipment rental invoices, ledgers, journals, daily reports, job diaries, and any documentation related to the requirements of Section 2.25 - CHANGES TO THE WORK. In the case of a continuing delay, only one (1) claim is necessary. If adverse weather conditions are the basis for a claim for additional time, such claim shall be documented by data substantiating that weather conditions were abnormal for the period of time and could not have been reasonably anticipated, and that weather conditions had an adverse effect on the critical activities on the construction schedule. The Contractor shall certify, at the time of submission of a claim, as follows:

"I, _____, being the _____ (MUST BE AN OFFICER) of _____ (GENERAL CONTRACTOR), declare under penalty of perjury under the laws of the State of California, and do personally certify and attest that: I have thoroughly reviewed the attached claim for additional compensation and/or extension of time, and know its contents, and said claim is made in good faith; the supporting data is truthful and accurate; the amount requested accurately reflects the contract adjustment for which the Contractor believes the Owner is liable; and, further, that I am familiar with California Penal Code Section 72 and California Government Code Section 12560, et seq, pertaining to false claims, and further know and understand that submission or certification of a false claim may lead to fines, imprisonment and/or other severe legal consequences.

By: _____
(Contractor's signature) (Date)

D. Nothing in this Article is intended to extend the time limit or supersede notice requirements otherwise provided by this contract or by applicable law for the filing of claims. Any formal claim shall be processed in accordance with the provisions of Public Contract Code Section 9204 and Section 20104 et. seq., each of which establishes a process for resolution of claims, the provisions of which are consistent with and effectively summarized by the following

1. The Owner (or his/her designee), shall review the facts pertinent to the claim, obtain additional information deemed necessary for a decision (if any), review recommendations of the Project Manager, coordinate with the contract administrator (if any) and secure assistance from legal and other advisors, and render a written decision on the claim within forty-five (45) days of receipt of the claim. If additional information or documentation is thereafter required, it shall be requested and provided pursuant to this subdivision, upon mutual agreement of the Owner (or his/her designee) and claimant. The Owner's (or his/her designee's) written response to the claim, as supplemented by any additional information and/or documentation provided by claimant, shall be submitted to the claimant within fifteen (15) days after receipt of the further information and/or documentation or within a period of time no greater than that taken by the claimant in producing the additional information, whichever is greater.

a. For claims of over fifty thousand dollars (\$50,000) and less than or equal to three hundred seventy-five thousand dollars (\$375,000), the Owner (or his/her designee), shall respond in writing to all written claims within 60 days of receipt of the claim, or may request, in writing, within 30 days of receipt of the claim, any additional documentation supporting the claim or relating to defenses to the claim the Owner (or his/her designees) may have against the claimant.

2. If the claimant disputes the written response of Owner (or his/her designee), or Owner fails to respond within the time prescribed, the claimant may so notify the Owner (or his/her designee), in writing, either within fifteen (15) days of receipt of the Owner (or his/her designee's) response or within fifteen (15) days of the Owner (or his/her designee's) failure to respond within the time prescribed, respectively, and demand an informal conference to meet and confer for settlement of the issues in dispute. Upon a demand, the Owner (or his/her designee) shall schedule a meet and confer conference within thirty (30) days for settlement of the dispute.
 3. Within ten (10) business days following conclusion of the meet and confer conference, any unpaid portion of the claim remaining in dispute shall be submitted to nonbinding mediation, as that term is defined by Public Contract Code Section 9204(d)(2)(C).
 4. If following the conclusion of the meet and confer conference and mediation process, the claim or any portion thereof remains in dispute, the claimant may file a claim pursuant to Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the Government Code. For purposes of those provisions, the running of the period of time within which a claim must be filed shall be tolled from the time the claimant submits his/her written claim pursuant to subdivision (a) until the time the claim is denied, including any period of time utilized by the meet and confer conference and mediation process as described in the immediately preceding Paragraphs 2 and 3 of this Section D.
 5. In the event of any perceived conflict between the summary of the procedure set forth in this Article and the actual provisions of the Public Contract Code Section 9204 and Section 20104, et seq., the statutory provisions shall control; and in the event of any perceived conflict between the provisions of Section 9204 and Section 20104, et seq., the provisions of Section 9204 shall control.
- E. Procedures for Civil Actions to Resolve Disputed Claims: Non-binding Mediation: Within sixty (60) days, but no earlier than thirty (30) days, following the filing of a responsive pleading, the court shall submit the matter to non-binding mediation unless waived by mutual stipulation by both parties. The mediation process shall provide for the selection within fifteen (15) days by both parties of a disinterested third person as mediator, shall be commenced within thirty (30) days of the submittal, and shall be concluded within fifteen (15) days from the commencement of the mediation unless a time requirement is extended upon a good cause shown to the court. If the parties fail to select a mediator within the 15-day period, any party may petition the court to appoint the mediator.

Judicial Arbitration: If the matter remains in dispute, the case shall be submitted to judicial arbitration pursuant to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, notwithstanding Section 1141.11 of the code. The Civil Discovery Act of 1986 (Article 3 (commencing with Section 2016) of Chapter 3 of Title 3 of Part 4 of the Code of Civil Procedure) shall apply to any proceeding brought under this

subsection consistent with the rules pertaining to judicial arbitration. Arbitrators shall be experienced in construction law.

Appeals: As provided by statute (specifically Public Contract Code section 20104.4(b)(3) and Code of Civil Procedure section 1141.21), any party appealing an arbitration award who does not obtain a more favorable judgment shall, in addition to payment of costs and fees, also pay the attorneys' fees on appeal of the other party.

- F. CLAIMS AND DISPUTES EXEMPT FROM FILING REQUIREMENTS. The requirements and procedures imposed by this Article do not apply to:
1. Any claims by the Owner; or
 2. Any claim for or respecting personal injury or death or reimbursement or other compensation arising out of or resulting from liability for personal injury or death; or
 3. Any claim or dispute relating to stop payment requests or stop notices; or
 4. Any claim or dispute related to the approval, refusal to approve, or substitution of Subcontractors, regardless of tier, and suppliers.
- G. PAYMENT OF UNDISPUTED PORTION OF CLAIM. Owner shall pay claimant such portion of a claim that is undisputed except as otherwise provided in the contract.
- H. CONTINUE WORK DURING DISPUTE. In the event of any disputed claim or other dispute between the Owner and the Contractor, the Contractor will not stop work but will prosecute the work diligently to completion in his/her manner directed by the Owner, and the dispute shall be resolved by a court of law after completion of the Work. However, Contractor must submit all disputes in accordance with the provisions of this Section 2.35.
- I. SUIT IN FRESNO COUNTY ONLY. Any litigation arising out of this Contract shall be brought in Fresno County and Contractor hereby waives the removal provisions of California Code of Civil Procedure Section 394.

2.36 PERFORMANCE BOND, LABOR AND MATERIAL PAYMENT BOND AND WARRANTY BOND

- A. The Contractor shall furnish Performance Bond in the amount of one hundred percent (100%) of the Contract Sum, and Payment Bond in the amount of one hundred percent (100%) of the Contract Sum and One Year Warranty Bond in the amount of ten percent (10%) of the Final Contract Sum, which is the cumulative amount that will have been paid to Contractor for all of the Work performed under the Contract once the Project has been completed and the Work has been accepted by the County.]

- B. All bonds required, whether Bid bonds, Performance, Payment, Warranty or other bonds, shall be issued by an admitted surety insurer authorized by the California Insurance Commissioner to transact surety insurance in the state. The same admitted surety insurer must issue the Bid Bond, Performance Bond, Payment Bond, and Warranty Bond. The payment, performance and warranty bonds required by these specifications will neither be accepted nor approved by the Owner unless the bonds are underwritten by an admitted surety and the requirements of California Code of Civil Procedure section 995.630 are met. The bonds must include a physical mailing address, phone number, FAX number, and contract person for the admitted surety insurer. The Owner further reserves the right to satisfy itself as to the acceptability of the surety and the form of bond. Upon request of the Owner, the bidder must submit the following documents:
1. The original, or a certified copy, of the unrevoked appointment, power of attorney, bylaws, or other instrument authorizing the person who executed the bond to do so.
 2. A certified copy of the certificate of authority of the insurer issued by the California Insurance Commissioner.
 3. A certificate from the county clerk that the certificate of authority has not been surrendered, revoked, canceled, annulled, or suspended, or in the event that it has, that renewed authority has been granted.
 4. A financial statement of the assets and liabilities of the insurer to the end of the quarter calendar year prior to thirty (30) days next preceding the date of the execution of the bond, in the form of an officers' certificate as defined in Corporations Code section 173.

2.37 RIGHTS AND REMEDIES

- A. The duties and obligations imposed by the Contract Documents and the rights and remedies available hereunder shall be in addition to, and not a limitation of, any duties, obligations, rights and remedies otherwise imposed or available by law.
- B. No action or failure to act by the Owner, or by the Project Manager or Architect, regarding any deficiency, breach or default in performance by the Contractor under the Contract Documents, shall be deemed or construed to constitute acquiescence of the Owner in connection therewith or with regard to any subsequent deficiency, breach or default in performance by the Contractor; nor shall any such prior act of failure to act by or on behalf of Owner be deemed or construed as a waiver of any rights in favor of Owner regarding any such deficiency, breach or default in performance by the Contractor, regardless of the similarity to the prior incident or circumstance when no action was taken regarding any alleged deficiency, breach or default in performance by the Contractor.

2.38 TIME, DELAYS AND LIQUIDATED DAMAGES

A. DEFINITIONS

1. Unless otherwise provided, the contract time is the period of time allotted in the Contract Documents for completion of the Work, including authorized adjustments thereto.
2. The Date of Commencement of the Work is the date established in the Notice to Proceed.
3. The Date of Completion of the Work is the date on which the work is certified as complete by the Project Manager as specified in the Notice of Completion.
4. The term "day" as used in the Contract Documents shall mean calendar day unless specifically designated otherwise.

B. PROGRESS AND COMPLETION

1. Time is of the essence regarding all time limits stated in the Contract Documents. By executing the Agreement, the Contractor confirms that the contract time is a reasonable period for performing the Work.
2. The Contractor shall begin the Work on the Date of Commencement. The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required herein to be furnished by the Contractor. The Date of Commencement of the Work shall not be changed by the effective date of such insurance.
3. The Contractor shall carry the Work forward expeditiously with adequate forces and shall achieve Completion of the Work within the contract time.

C. DELAYS AND EXTENSIONS OF TIME

1. Delays in prosecution of parts or classes of the Work that are not demonstrated to prevent or delay completion of the entire Project or specific milestones within the contract time are not "unavoidable delays" for purposes of this section.
2. In all cases, the time authorized for extension of the contract time shall be no greater than the number of days directly attributable to the event or circumstances which causes unavoidable delay in the completion of the Project. Contractor shall be entitled, in the case of unavoidable delays, to an extension in the contract time, but not to any increase to the Contract Sum. "Unavoidable delay" for this purpose shall be defined as follows:

- a. Unavailable Materials. That materials or articles called for in the Contract Documents are not obtainable within the time required for timely completion; provided that such materials or articles were listed by the Contractor in the schedule required by Section 2.17 - CONTRACTOR'S CONSTRUCTION SCHEDULE; that the Contractor demonstrates that the unavailability of the materials is in fact the cause for the delay, and could not have been avoided by an appropriate adjustment in the Construction Schedule; and that the unavailability of such materials is due to circumstances beyond the Contractor's control. If good cause for delay is demonstrated pursuant to this subsection, the Owner, at its sole discretion, may grant a time extension.
- b. Force Majeure. That delays in construction have resulted from circumstances beyond the control of the Contractor and which the Contractor could not have provided against by the exercise of reasonable care, prudence, foresight, and diligence. Unavoidable delays within the meaning of this subparagraph shall be those caused by acts of God, war, insurrection, civil disorder, fire, floods, epidemic, or strikes.
- c. Unseasonable Weather. An extension of contract time may be granted due to weather which is unsuitable for the Work currently in progress, upon the determination of the Owner that the weather conditions in fact caused the delay in completion of the Project and that such weather conditions were not, and could not in the exercise of reasonable diligence, have been foreseen by the Contractor. Seasonable weather that, in the exercise of reasonable foresight and diligence, should be expected in the area at the time of year in question is not cause for an extension of time.
- d. Time Extensions Due to Contract Change Orders or Work Authorizations. A time extension may be granted due to additional work that results in a delay in the Project caused by the approval by the Owner of a Contract Change Order or Work Authorization. The Contractor shall be entitled to a contract time extension Change Order only when the extra Work is demonstrated by the Contractor to have caused a delay in the Project.
- e. Owner Caused Delays. In the event that the Project is delayed by acts of the Owner not authorized by the Contract Documents which the Contractor demonstrates will or have caused an unavoidable delay, the Contractor shall be entitled to a contract time Change Order to offset the extra time incurred by the Contractor. The Contractor will not be entitled to adjustments in the Contract Sum. Extra time shall be limited to that which is directly identified as critical by the delay.

4. The Contractor specifically agrees that a time extension as provided herein is its sole remedy for Owner-caused delays, and agrees to make no claim or demand for additional damages, nor claim an acceleration of the time for performance.
5. The Contractor shall not be entitled to any contract time extension nor Contract Sum adjustment for alleged Owner delays if the Owner has acted within the time limits specified by the Contract Documents.

D. NOTICE OF DELAYS

1. Contractor shall notify the Project Manager promptly whenever the Contractor foresees any event or circumstance that may delay the prosecution of the Work and in Contractor's opinion may provide grounds for an extension, and shall in any event notify the Project Manager immediately upon the occurrence of any such delay. The Contractor shall take immediate steps to prevent, if possible, the occurrence or continuance of the delay. If this cannot be done, the Project Manager shall determine how long the delay shall continue and to what extent the prosecution and completion of the Work are being delayed thereby. Such notification shall specify with detail the cause asserted by the Contractor to constitute grounds for an extension. Failure of the Contractor to submit such a notice within ten (10) days after the initial occurrence of the event-giving rise to the delay shall constitute a waiver by the Contractor of any request for a time extension, and no extension shall be granted as a consequence of such delay.
2. If the Contractor believes that the delay in prosecution in the Work will result in an unavoidable delay in completion of the entire Project, the Contractor shall submit evidence to support that belief, together with its request for a time extension. Such evidence shall include a demonstration that the delayed portion of the Work will affect the Critical Path Scheduling of the entire Project. The Contractor shall also submit a proposed revised Construction Schedule, which accounts for the delay in completion of the entire Project caused by the delay in prosecution of part of the Project, and includes a revised Critical Path demonstrating how the Project will be completed within the proposed revised contract time.

E. INVESTIGATION; PROCEDURE.

1. Upon receipt of a request for Time extension, the Project Manager shall conduct an investigation of the facts asserted by the Contractor to constitute grounds for an extension. The results of this investigation shall be reported by the Project Manager to the Contractor and shall indicate whether he/she will recommend for or against such extension to the Owner. The performance of this investigation by the Project Manager shall not be construed as direction or recommendation to the Contractor regarding scheduling of the work. Scheduling this work is the sole responsibility of the Contractor.

2. The Project Manager may, in his/her sole discretion, defer this recommendation to allow the accumulation of time extensions due to Work Authorizations into a periodic or final Contract Change Order request.
3. Upon receiving the Project Manager's recommendation to the Owner regarding the Contractor's request for a time extension, the Contractor may either withdraw its application for extension or request that it be scheduled for action by the Owner. If the Owner disallows the request, there shall be no allowance made for the time during which the request was pending, and the Contractor shall remain obligated to complete the Work in the time specified.
4. If the Owner approves the time extension Contract Change Order, the new Construction Schedule submitted by the Contractor and approved by the Owner shall be deemed to amend the original Construction Schedule approved by the Owner; thereafter, the amended Construction Schedule shall have the same force and effect as the originally approved Progress Schedule.
5. The revised Construction Schedule must be submitted within seven (7) calendar days of the date on which the Owner approves the change.
6. The Contractor agrees that the Owner's determination as to the existence of grounds for an extension and, the duration of any such extension, shall be final and binding upon both Owner and Contractor.

F. DISCRETIONARY TIME EXTENSION FOR BEST INTEREST OF OWNER

1. The Owner reserves the right to extend the contract time for completion of the Work if the Director of Public Works and Planning or designee determines that such extension is in the best interest of the Owner.
2. In the event that such discretionary extension is made at the request of the Contractor, the Owner shall have the right to charge to the Contractor all or any part, as the Board may deem proper, of the actual cost to the Owner for engineering, inspection, supervision, contract administration, incidental and other overhead expenses that accrue during the period of such extension, and to deduct all or any portion of such amounts from the final payment for the Work.
3. In the event such extension is ordered over the objection of the Contractor, the Contractor shall be entitled to a Contract Change Order adjusting the price paid to reflect the actual costs incurred by the Contractor as a direct and proximate result of the delay, upon his/her written application therefor, accompanied by such verification of costs as the Project Manager requires. Only additional direct costs incurred at the site will be reimbursable by Contract Change Order.

G. LIQUIDATED DAMAGES

1. If the Work is not completed by Contractor in the time specified in the Work Order or within any period of extension authorized pursuant to this Article, the Contractor acknowledges and admits that the Owner will suffer damage, and that it is impracticable and infeasible to fix the amount of actual damages. Therefore, it is agreed by and between the Contractor and the Owner that the Contractor shall pay to the Owner as fixed and liquidated damages, and not as a penalty, the sum specified in Section 005213, Agreement, Article III for each calendar day of delay until the Work is completed and accepted, and that both the Contractor and the Contractor's surety shall be liable for the total amount thereof, and that the Owner may deduct said sums from any monies due or that may become due to the Contractor.
2. This liquidated damages provision shall apply to all delays of any nature whatsoever, save and except only unavoidable delays approved by the Owner pursuant to the provisions of Article 2.38.C.2 hereinabove, or discretionary time extensions approved by the Board of Supervisors pursuant to the provisions of Article 2.38.F hereinabove.

H. EXTENSION OF TIME NOT A WAIVER.

1. Any extension of contract time granted pursuant to this Article shall not constitute a waiver by the Owner, nor a release of the Contractor, from his/her obligations to perform the Work within the allotted contract time.
2. Granting of a time extension due to one (1) circumstance on one (1) request therefore shall not constitute a granting by the Owner of an extension of time for any other circumstance or the same circumstance occurring at some other time, and shall not be interpreted as a precedent for any other request for extension.

2.39 PROTECTION OF PERSONS AND PROPERTY

A. SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work.

B. SAFETY OF PERSONS AND PROPERTY

The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

1. All employees on the Work and all other persons who may be affected thereby;
2. All the work and all materials and equipment to be incorporated therein, whether in storage or off the site, and that is under the care, custody or control of the Contractor or any of the Contractor's Subcontractors or Sub-subcontractors;
3. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction; and
4. The work of the Owner or other separate contractors.

C. The Contractor shall give all notices and comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the safety of persons or property or their protection from damage, injury or loss.

D. The Contractor shall erect and maintain, as required by existing conditions and the progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent facilities.

E. When the use or storage of explosives or other hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel.

F. The Contractor shall promptly remedy all damage or loss to any property referred to above caused in whole or in part by the Contractor, any Subcontractor, any Sub-subcontractor, anyone directly or indirectly employed by any of them, or any one for whose acts any of them may be liable, and for which the Contractor is responsible under the above noted clauses, except damage or loss attributable solely to the acts or omissions of the Owner, the Project Manager, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and not attributable in any degree to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under the Indemnification provisions provided herein.

G. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and the Project Manager.

H. The Contractor shall not load or permit any part of the Work to be loaded in a manner that could endanger its safety or pose a risk to anyone working at the Project site.

I. EMERGENCIES

In any emergency affecting the safety of persons or property the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Any additional compensation or extension of time claimed by the Contractor on account of emergency work shall be determined as provided in the provisions herein for Changes in the Work.

2.40 INSURANCE

A. CONTRACTOR'S INSURANCE

1. Bidders' attention is directed to the insurance requirements below. It is highly recommended that Bidders confer with their respective insurance carriers or brokers to determine in advance of bid submission the availability of the insurance certificates and endorsements required below. A bidder who is awarded a contract and thereafter fails to comply strictly with the insurance requirements, will be deemed to be in default of its obligations.
2. Contractor shall procure and maintain for the duration of the Contract, and for 3 years thereafter, insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees, or subcontractors. The cost of such insurance shall be included in the Contractor's bid.
3. No later than ten (10) calendar days following the Award of the Contract, and prior to execution of the Agreement for Construction by the Owner, the Contractor shall submit certificates of insurance, signed by an authorized agent of the insurer, attesting to insurance coverage of the Contractor as required by this Article.

B. MINIMUM SCOPE AND LIMITS OF INSURANCE

Coverage shall be at least as broad as:

1. Commercial General Liability (CGL): Insurance Services Office (ISO) Form CG 00 01 covering CGL on an "occurrence" basis, including products and completed operations, property damage, bodily injury and personal & advertising injury with limits no less than five million dollars (\$5,000,000) per occurrence and an annual aggregate of ten million dollars (\$10,000,000). If a general aggregate limit applies, either the general aggregate limit shall apply separately to this project/location (ISO CG 25 03 or 25 04) or the general aggregate limit shall be three times the required occurrence limit.

2. Automobile Liability: Insurance Services Office (ISO) Form CA 0001 covering Code 1 (any auto), with limits no less than five million dollars (\$5,000,000) per accident for bodily injury and property damage. Coverage should include owned and non-owned vehicles used in connection with this Agreement and all applicable endorsements.
3. Workers' Compensation insurance as required by the State of California, with Statutory Limits, and Employers' Liability insurance with a limit of no less than one million dollars (\$1,000,000) per accident for bodily injury or disease.
4. If Contractor is a licensed professional or employs professional staff, (e.g., Architect, Engineer, Surveyor, etc.) in providing services, Professional Liability with limits no less than \$2,000,000 per occurrence or claim, and \$3,000,000 annual aggregate.
5. Builder's Risk (Course of Construction) insurance utilizing an "All Risk" (Special Perils) coverage form, with limits equal to the completed value of the project and no coinsurance penalty provisions.

If Contractor maintains broader coverage and/or higher limits than the minimums shown above, the Owner requires and shall be entitled to the broader coverage and/or the higher limits maintained by the Contractor. Any available insurance proceeds in excess of the specified minimum limits of insurance and coverage shall be available to the Owner.

Self-Insured Retentions

Self-insured retentions must be declared to and approved by the Owner. At the option of the Owner, either: the Contractor shall obtain coverage to reduce or eliminate such self-insured retentions as respects the Owner, its officers, officials, employees, and volunteers; or the Contractor shall provide a financial guarantee satisfactory to the Owner guaranteeing payment of losses and related investigations, claim administration, and defense expenses. The policy language shall provide, or be endorsed to provide, that the self-insured retention may be satisfied by either the named insured or Owner.

C. OTHER INSURANCE PROVISIONS

Contractor's insurance policies are to contain, or be endorsed to contain, the following provisions:

1. The coverage shall contain no special limitations on the scope of protection afforded to the Owner, its officers, officials, employees or volunteers.

2. The County of Fresno, its officers, officials, employees, and volunteers are to be named individually and collectively, as additional insureds on the CGL policy with respect to liability arising out of work or operations performed by or on behalf of the Contractor including materials, parts, or equipment furnished in connection with such work or operations and automobiles owned, leased, hired, or borrowed by or on behalf of the Contractor. The coverage shall contain no special limitations on the scope of protection afforded to the Owner, its officers, officials, employees or volunteers.
3. The insurer shall agree to waive all rights of subrogation against the Owner, its officers, officials, employees and volunteers for losses arising from work performed by the Contractor for the Owner
4. For any claims related to this project, the Contractor's insurance coverage shall be primary insurance coverage at least as broad as ISO CG 20 01 04 13 as respects the Owner, its officers, officials, employees, and volunteers. Any insurance or self-insurance maintained by the Owner, its officers, officials, employees, or volunteers shall be excess of the Contractor's insurance and shall not contribute with it.
5. Any failure to comply with reporting provisions of the policies shall not affect Coverage provided to the Owner, its officers, officials, employees, agents, Engineers, Consulting Engineers, or volunteers.
6. The Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.
7. All Contractor's insurance policies for coverage required under this agreement shall not be cancelled or changed without a minimum of thirty (30) days advance written notice given to Owner.
8. The insurer shall agree to waive all rights of subrogation against the Owner, its officers, officials, employees and volunteers for losses arising from work performed by the Contractor for the Owner.
9. The Builder's Risk (Course of Construction) policy shall be an "All Risk" (Special Perils) coverage form, with limits equal to the completed value of the project and no coinsurance penalty provisions. All subcontractors shall be insured to the extent of their portion of the work under the Contractor. The Contractor shall request, and is responsible to confirm with its insurer, that the County of Fresno and all subcontractors are named, both as additional insured and as additional loss payees, on the Builder's Risk insurance policy. The Contractor and all subcontractors waive all rights, each against the others, for damages arising from perils covered by the insurance required under the terms of this article, except such rights as they may have to the proceeds of the Builder's Risk insurance obtained and maintained by the Contractor.

D. ACCEPTABILITY OF INSURERS

Contractor shall obtain the policies and coverages specified herein from an admitted insurer in good standing with and authorized to transact business in this state by the California Department of Insurance, and having a Best's rating of no less than A FSC VIII.

E. SUBCONTRACTORS

Contractor shall include all Subcontractors as insured under its policies or shall furnish separate certificates and endorsements for each Subcontractor.

F. EVIDENCE OF COVERAGE

Within ten (10) days of bid award, Contractor shall furnish the Owner with original Certificates of Insurance including all required amendatory endorsements (or copies of the applicable policy language effecting coverage required by this Article 2.40) and a copy of the Declarations and Endorsement Page of the CGL policy listing all policy endorsements to Owner. However, failure to obtain the required documents prior to the work beginning shall not waive the Contractor's obligation to provide them. The Owner reserves the right to require complete, certified copies of all required insurance policies, including endorsements, required by these specifications, at any time.

Certificates of Insurance and Endorsements for all policies must be signed by a person authorized by the insurer to bind coverage on its behalf, indicate the name and address of the official who will administer this contract, state that such insurance coverages have been obtained and are in full force and effect, and clearly indicate that coverage shall not be suspended, voided, canceled by either party, reduced in coverage or in limits except after thirty (30) days' prior written notice has been given to the Owner.

Commercial General Liability Endorsements must name the County of Fresno, its officers, agents and employees, individually and collectively, as additional insured, but only insofar as the operations under this Agreement are concerned; that such coverage for additional insured shall apply as primary insurance and any other insurance, or self-insurance, maintained by Owner, its officers, agents and employees, shall be excess only and not contributing with insurance provided under Contractor's policies herein.

2.41 UNCOVERING WORK

- A. This Section shall apply to any Work installed and covered up by the Contractor that is required by the Building Code or other statutory or regulatory requirement to undergo inspection or special inspection and/or testing approval by an appropriate official representing the Owner or other public authority having jurisdiction to conduct such inspection and/or testing. Work covered up by the Contractor, Contractor's Subcontractor's or Suppliers prior to inspection/special inspection and/or testing approval shall be uncovered and repaired or replaced after inspection approval at the sole expense of the Contractor. This shall apply to all labor and material needed to complete both physical and cosmetic repairs, and any additional inspection costs associated with restoring the Work.
- B. This Section also shall apply to any Work installed and covered up by the Contractor, Contractor's Subcontractor's or Suppliers that is determined by the Owner or its Project Manager, during construction or within the Warranty period, to be defective, broken or inoperative. Work covered up by the Contractor, Contractor's Subcontractor's or Suppliers that is found to be defective, broken or inoperative shall be uncovered and repaired or replaced at the sole expense of the Contractor. This shall apply to all labor and material needed to complete both physical and cosmetic repairs, and any additional inspection costs associated with restoring the Work.

2.42 CORRECTION OF WORK

- A. The Contractor shall promptly correct all Work rejected by the Project Manager as defective or as failing to conform to the Contract Documents, whether or not fabricated, installed or completed. The Contractor shall submit a plan of action, within twenty-four (24) hours of notification of the rejected work by the Project Manager, for correcting the rejected work. The Contractor shall bear all costs of correcting such rejected Work, including compensation for the additional architectural and/or engineering services made necessary thereby.
- B. If, within 365 Calendar Days after the date of acceptance of the Work as specified in the Notice of Completion, or designated portion thereof, or within 365 Calendar Days after acceptance by the Owner of designated equipment, or within such longer period of time as may be prescribed by the terms of any applicable special warranty required by the Contract Documents, any of the Work is found by Owner to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. This obligation shall survive both final payment for the Work or designated portion thereof and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.
- C. The Contractor shall, at his/her sole expense, remove from the site all portions of the Work that are defective or nonconforming and which have not been corrected under Articles 2.32, 2.42.A, and 2.42.B, unless the Owner waives removal.

- D. If the Contractor fails to submit a plan of action, within twenty-four (24) hours of notification of the rejected work by the Project Manager, for correcting the rejected work, or fails to correct defective or nonconforming Work as provided herein in Articles 2.32, 2.42.A, and 2.42.B, the Owner may correct it in accordance with Article 2.08.C.
- E. If the Contractor does not take action under the plan to initiate such correction of such defective or nonconforming Work within ten (10) days of written notice from the Project Manager, the Owner may remove it and may store the materials or equipment at the expense of the Contractor. If the Contractor does not pay the cost of such removal and storage within ten (10) days thereafter, the Owner may, upon ten (10) additional days' written notice, sell such Work at auction or at private sale and shall account for the proceeds thereof, after deducting all the costs that should have been borne by the Contractor, including compensation for the Project Manager, Architect, or other Professional's additional services made necessary thereby. If such proceeds of sale do not cover all costs that the Contractor should have borne, the difference shall be charged to the Contractor and an appropriate Supplemental Work Order shall be issued. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.
- F. The Contractor shall bear the cost of making good all work of the Owner or separate contractors destroyed or damaged by such correction or removal.
- G. Nothing contained in this Section 2.42 shall be construed to establish a period of limitation with respect to any other obligation which the Contractor might have under the Contract Documents, including Section 2.32 hereof. The establishment of the time periods noted in this Section 2.42, or such longer period of time as may be prescribed by law or by the terms of any warranty required by the Contract Documents, relates only to the specific obligation of the Contractor to correct the defective or nonconforming Work, and has no relationship to the time within which the Contractor's obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the defective or nonconforming Work.

2.43 ACCEPTANCE OF DEFECTIVE OR NONCONFORMING WORK

If the Owner prefers to accept defective or nonconforming Work, the Owner may do so instead of requiring its removal and correction, in which case a Contract Change Order will be issued to reflect a reduction in the Contract Sum where appropriate and equitable. Such adjustment shall be given effect whether or not final payment has been made. The Project Manager shall determine the amount of reduction in the Contract Sum.

2.44 TERMINATION BY THE OWNER

- A. If the Contractor is adjudged bankrupt, or makes a general assignment for the benefit of creditors, or if a receiver is appointed on account of the Contractor's insolvency, or stop notices are served upon the Owner, or if the Contractor persistently or repeatedly refuses or fails, except in cases for which extension of time is provided, to supply enough properly skilled workers or proper materials, or fails to make prompt payment to Subcontractors or for materials or labor, or persistently disregards applicable laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, or otherwise is guilty of a substantial violation of a provision of the Contract Documents, and fails after written notice to commence and continue correction of such default, neglect or violation with diligence and promptness, the Owner upon certification by the Project Manager that sufficient cause exists to justify such action, may, after an additional written notice and without prejudice to any other remedy the Owner may have, terminate the Contract and take possession of all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor and may finish the Work by whatever methods the Owner may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the Work is finished.
- B. If the unpaid balance of the Contract Sum exceeds the costs of finishing the Work, including compensation for the Project Manager's and Architect's additional services made necessary thereby, Contractor will only be paid for his/her actual unpaid costs from such excess. If such costs exceed the unpaid balance, the contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or to the Owner, as the case may be, shall be certified by the Project Manager, upon application, in the manner provided in Section 2.24 and this obligation for payment shall survive the termination of the Contract.

2.45 SUBSTITUTION OF MATERIALS

- A. When a specific manufacturer, trade name or material is specified, or indicated, it is to establish a standard of quality and shall not be construed as limiting competition. The intent of the Contract Documents is to specify high-grade standard material and equipment, and it is not the intent of these Contract Documents to exclude or omit the products of any responsible manufacturer, if such products are equally acceptable in terms of quality, finish, performance, durability, and serviceability, in the judgment of the Owner and the Architect, to those specified herein. Wherever an article, or any class of materials, is specified by the trade name or by the name of any particular patentee, manufacturer or dealer, it shall be taken as intending to mean and specify the article of material described or any other equal thereto in quality, finish, performance, durability, and serviceability, in the judgment of the Owner and the Architect, for the purpose for which it is or they are intended.

- B. If the Contractor desires to use material or equipment other than that specified, he/she shall submit a request for approval of such substitution, in writing, to the Project Manager by no later than 10 days prior to bid opening. Substitution requests will not be considered if received after the time stipulated.
- C. The Owner does not guarantee that alternative articles, components, materials or equipment other than the item specified by trade name or other specific identification, will fit within the design parameters of the Project without alteration of the Project design by the Contractor.
- D. The Owner has the right to reject any proposed alternative material which requires alteration of the project design which impacts the safety of the public or the user of a completed facility. If the proposed alternative material requires alteration of the design of the Project or any aspect thereof and said alterations are acceptable to the Owner, the Contractor shall be responsible for performing said alterations at no additional cost to the Owner.
- E. Submittals for approval of substitute materials shall contain sufficient detailed information, descriptive brochures, drawings, samples or other data as is necessary to provide a detailed side-by-side comparison to the specified materials. It is the sole responsibility of the Contractor to submit complete descriptive and technical information so the Project Manager can make proper appraisal. Lack of either proper or sufficient information shall constitute cause for rejection. Reference to product data will not be acceptable.
- F. It is the Contractor's responsibility to confirm and correlate all quantities and dimensions and coordinate with all trades whose work may be affected by the requested substitution.

2.46 REFERENCE TO STANDARDS

- A. Reference to known standards shall mean and intend the latest edition or amendment published prior to date of these Specifications, unless specifically indicated otherwise, and to such portions of it that relate and apply directly to the material or installation called for on the Project.
- B. Where material is specified solely by reference to standard specifications, the Contractor shall, if requested by the Project Manager, submit to the Project Manager for his/her approval, data on all such material proposed to be incorporated into the Work of the Contractor, listing the name and address of the vendor, the manufacturer or producer, and the trade or brand names of such materials.

2.47 SPECIFICATIONS

- A. The Specifications are organized into Divisions, Sections, and Trade headings based on the Construction Specifications Institute's Master format and the Master format numbering system. This organization shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of the Work to be performed by any trade. The Contractor shall be responsible for examining all Sections of the Specifications for inter-related items of the Work, and for furnishing each item identified or specified.
- B. No responsibility will be assumed by the Owner, Architect or the Project Manager for omissions or duplications by the Contractor in the completion of the Contract due to any alleged discrepancy in the arrangement of the material in these Specifications, nor shall any such segregation of work and materials operate to make the Project Manager an arbiter in defining the limits to the agreements between the Contractor and his/her Subcontractors or suppliers.
- C. The misplacement, addition or omission of any letter, word or punctuation mark shall in no way damage the true spirit, intent or meaning of these Specifications.
- D. The words "shown", "indicated", "noted", "scheduled" or words of that effect shall be understood to mean that reference is made to Drawings accompanying these Specifications.
- E. Where reference herein is made to colors or finishes "as selected", the reference is to the Architect with concurrence by the Owner.

2.48 APPROVED APPLICATORS

- A. Where specific instructions in these Specifications require that a particular product and/or materials be installed and/or applied by an "approved applicator" of the manufacturer, it shall be the Contractor's responsibility to ensure that any Subcontractors used for such work be approved applicators.
- B. Contractor accordingly shall bear any and all costs, and shall reimburse Owner for any such costs incurred by Owner, resulting from Contractor's failure to insure the use of an "approved applicator".

2.49 DELIVERY AND STORAGE OF MATERIALS

- A. Deliver all manufactured materials in the original packages, containers or bundles (with the seals intact), bearing the name or identification mark of all manufacturers.
- B. Deliver fabrications in as large assemblies as practicable and where specified to be shop-primed or shop-finished; they shall be packaged or crated as required to preserve such priming or finish intact and free from abrasion.

- C. Store all materials in such manner as necessary to properly protect same from damage, as materials or equipment damaged by handling, weather, dirt or from any other cause will not be acceptable.
- D. Store materials so as to cause no obstructions (i.e. stored off all sidewalks and other walkways, roadways, and underground services). The Contractor shall be responsible for protecting from damage all material and equipment furnished under the Contract.

2.50 QUALITY OF WORK

- A. Where not more specifically described in any of the various Sections of these Specifications, the quality of work shall conform to all of the methods and operations of best standards and accepted practices of the trade or trades involved, and shall include all items of fabrication, construction, or installation regularly furnished or required for completion of the work (including any finish), and for successful operation as intended of the Project and the component thereof corresponding to that work.
- B. All Work shall be executed by mechanics skilled in their respective lines of work.
- C. When completed, all parts shall have been durably and substantially built and shall present a neat, finished appearance.

2.51 HOURS OF WORK

- A. Eight (8) hours of labor shall constitute a legal day's work upon all work done hereunder, and it is expressly stipulated that no worker employed at any time by the Contractor, or by a Subcontractor under this Contract, upon the Work, shall be required or permitted to work thereon more than eight (8) hours in any one (1) calendar day and forty (40) hours in any one (1) calendar week, except as provided in Sections 1810-1815 inclusive, of the Labor Code of the State of California, all the provisions of which are deemed to be incorporated herein as if set forth in full; and it is further expressly stipulated that for each and every violation of said last named stipulation, said Contractor shall forfeit, as a penalty to the Owner, fifty dollars (\$50.00) for each worker employed by the Contractor in the execution of this Contract, for each calendar day during which said worker is required or permitted to labor more than eight (8) hours in any one (1) calendar day and forty (40) hours in any one (1) calendar week in violation of any of said provisions of the Labor Code.
- B. Notwithstanding the above stipulations, pursuant to Section 1815 of the Labor Code, work performed by employees of contractors in excess of eight (8) hours per day and forty (40) hours during any one (1) week shall be permitted on the Project upon compensation for all hours worked in excess of eight (8) hours per day at not less than one and a half (1 1/2) times the basic rate of pay.

2.52 WAGE RATES AND RELATED LABOR COMPLIANCE REQUIREMENTS

- A. This Project is subject to compliance monitoring and enforcement by the Department of Industrial Relations (DIR), including the obligation to submit certified payroll records directly to the DIR Compliance Monitoring Unit (CMU) at least monthly using the CMU's eCPR system. Detailed information may be obtained on the State of California's Department of Industrial Relations website, www.dir.ca.gov/dlse/cmu/CMU.

The Contractor shall also submit certified payroll records of the Contractor, Subcontractors and all Sub-subcontractors of any tier to the Inspector of Record at least monthly.

- B. Contractor shall, and shall cause each of its Subcontractors (as defined in Labor Code section 1722.1) to provide written proof that they are currently registered with the California Department of Industrial Relations at the time of bid submittal, and have paid the applicable annual fee and are thereby qualified to submit a bid and to perform public work pursuant to Labor Code section 1725.5, prior to award of this Contract or any subcontract hereunder. No bid shall be accepted, nor shall this Contract or any subcontract hereunder, be entered into without such proof.
- C. Pursuant to Section 1770-1780 of the Labor Code of the State of California, the Director of the Department of Industrial Relations has determined the general prevailing rates of wages and rates for legal holidays and overtime in the locality in which this work is to be performed, which under Labor Code Section 1773.1 are deemed to include employer payments for health and welfare, pension, vacation, travel time and subsistence pay, and apprenticeship or other authorized training programs, for each craft or type of worker or mechanic needed to perform this contract. Said wage rates are available only at the Fresno County Department of Public Works and Planning, Design Division, and will be made available to any interested person upon request. Minimum wage rates for this Project, as predetermined by the Secretary of Labor, are set forth in the Special Provisions. If there is a difference between the minimum wage rates predetermined by the Secretary of Labor and the Prevailing Wage Rates predetermined by the Director of the Department of Industrial Relations of the State of California for similar classifications of labor, the contractor and his subcontractors shall pay not less than the higher wage rate.
- D. It shall be mandatory upon the Contractor to whom the Contract is awarded, and upon any Subcontractor under him/her to pay not less than the said specified rates to all laborers, workers, and mechanics employed by them in the execution of the Contract, and to pay all laborers, workers and mechanics not less often than once weekly. The Contractor to whom the Contract is awarded shall post a copy of the determination of prevailing wages at the job site. The Contractor shall require all Subcontractors to comply with Sections 1770-1780 of the Labor Code of the State of California and shall insert into every subcontract the requirements contained therein.

- E. The Contractor shall comply with Labor Code Section 1775. In accordance with said Section 1775, it is hereby further agreed that the Contractor shall forfeit to the Owner, as a penalty, fifty dollars (\$50.00) for each laborer, worker, or mechanic employed for each calendar day or portion thereof, who is paid less than the said stipulated rates for any work done under the Contract, by him/her or by any Subcontractor under him/her. The difference between said stipulated rates and the amount paid to each worker for each calendar day or portion thereof for which each worker was paid less than said stipulated rate shall be paid to each worker by the Contractor. The Contractor, and each Subcontractor, shall keep or cause to be kept an accurate record showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker or other employee employed by him/her or her in connection with the public work. The records shall be open at all reasonable hours to the inspection of the Owner, to its officers and agents, and to the Division of Labor Law Enforcement of the State Department of Industrial Relations, its deputies and agents, or as otherwise provided by applicable law (including but not limited to Labor Code 1776).
- F. In case it becomes necessary for the Contractor or any Subcontractor to employ on the Work under this Contract any person in a trade or occupation (except executive, supervisory, administrative, clerical or other non-manual workers as such) for which no minimum wage rate is specified, the Contractor shall immediately notify the Owner who shall promptly thereafter determine the prevailing rate for such additional trade or occupation from the time of the initial employment of the person affected and during the continuance of such employment.

2.53 APPLICATION OF HIGHEST STANDARDS AND REQUIREMENTS

Whenever two (2) or more standards or requirements appear in these General Conditions or in any other part of the Contract Documents that form the Contract, the highest standard or requirement shall be applied and followed in the performance under this Contract.

2.54 NONDISCRIMINATION IN EMPLOYMENT

Contractor shall comply with all Federal and State Laws prohibiting discrimination in employment, including the following:

- A. California Labor Code Section 1735, which prohibits discrimination in employment on any basis listed in subdivision (a) of Section 12940 of the Government Code, as those bases are defined in Sections 12926 and 12926.1 of the Government Code, except as otherwise provided in Section 12940 of the Government Code, and applies to all employers, employment agencies and labor organizations.

- B. Title VII of the Federal 1964 Civil Rights Act (42 U.S.C. Section 2000e - 2000e - 17) which prohibits employment discrimination on the basis of race, color, sex, religion, or national origin, and applies to all employers that employ at least fifteen (15) workers during each working day in each of twenty (20) or more calendar weeks in the current or preceding year.
- C. In addition to these two (2) laws of general application listed in the immediately preceding paragraphs A and B, there are other Federal and State laws that prohibit employment discrimination in particular cases.
- D. The Owner is an Affirmative Action Employer and expects all of its contractors and suppliers to familiarize themselves with, and comply with, all applicable laws relating to employment discrimination.
- E. To the extent required by law, the Contractor shall meet all requirements of law relating to the participation of minority, women, and disabled veteran business enterprise contracting goals, and shall comply with Public Contract Code 10115 et seq. and all applicable regulations. Contractor further agrees that, when required, Contractor shall ensure compliance by all Subcontractors and shall complete all forms required by all agencies exercising jurisdiction over the Project.

2.55 APPRENTICES

- A. Pursuant to Sections 1770-1780 of the Labor Code of the State of California, the Director of the Department of Industrial Relations has determined the general prevailing rate of wages in the locality for each craft or type of worker needed to execute the work. Said wage rates pursuant to Section 1773.2 of the Labor Code are on file with the Clerk of the Fresno County Board of Supervisors, and will be made available to any interested person on request. A copy of this wage scale may also be obtained at the following Web Site: www.dir.ca.gov/dlsr.
- B. Pursuant to Section 1775 of the Labor Code of the State of California, nothing in this Article shall prevent the employment of properly registered apprentices upon public works. Every such apprentice shall be paid the standard wage paid to apprentices under the regulations of the craft or trade at which he/she is employed, and shall be employed only at the work of the craft or trade to which he/she is registered.
- C. Only apprentices, as defined in Section 3077, who are in training under apprenticeship standards and written apprentice agreements under Chapter 4 (commencing at Section 3070), Division 3, of the Labor Code, are eligible to be employed on public works. The employment and training of each apprentice shall be in accordance with the provisions of the apprenticeship standards and apprentice agreements under which he/she is training.

- D. Fresno County is committed to increasing the availability of employment and training opportunities, with particular attention to the plight of those who are most economically disadvantaged. In an effort to advance that purpose, the County will require that the Contractor and each subcontractor employed on this Project shall use their best efforts to ensure that thirty-three percent (33%) of apprentice hours, as determined by California Labor Code Section 1777.5 for each contractor and subcontractor of any tier on this Project, are performed by qualified participants in state approved apprenticeship programs who also are current or former "Welfare-to-Work" participants in the CalWORKs program. Provided, that nothing contained in this Paragraph D shall be interpreted to relieve or in any way diminish the obligation of the Contractor and each subcontractor to comply fully with all applicable apprenticeship laws in accordance with the California Labor Code and the California Code of Regulations; and accordingly such requirements as are contractually imposed by this Paragraph D shall be in addition to such legally mandated requirements, and applicable only to the extent fully consistent therewith.
- E. Incentives whereby the Contractor or Subcontractor receives partial reimbursement for the wages paid to apprentices who qualify may be available. The incentive program is administered by the County of Fresno, Department of Social Services. For questions regarding the incentive program, contact the Department of Social Services at (559) 230-4008.

2.56 PROVISIONS REQUIRED BY LAW DEEMED INSERTED

Every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted, and this contract shall be read and enforced as though it were included, and if through mistake or otherwise any provision is not inserted or is not correctly inserted, upon application of either party the contract shall be amended to make the insertion or correction.

2.57 DRUG FREE WORKPLACE CERTIFICATION

- A. The Contractor shall comply with Government Code Section 8355 in matters relating to providing a drug-free workplace.
- B. The Contractor shall publish a statement notifying employees that unlawful manufacture, distribution, dispensation, possession, or use of controlled substance is prohibited and specifying actions to be taken against employees for violations, as required by Government Code Section 8355(a).

- C. The Contractor shall establish a Drug-Free Awareness Program as required by Government Code 8355(a)(2), to inform employees about all of the following:
1. The dangers of drug abuse in the workplace,
 2. The Contractor's policy for maintaining a drug-free workplace,
 3. Any available counseling, rehabilitation and employee assistance programs,
 4. Penalties that may be imposed upon employees for drug abuse violations.
- D. Provide as required by Government Code 8355(c), that everyone who provides work under the Agreement.
1. Will receive a copy of the company's drug-free policy statement, and
 2. Will agree to abide by the terms of the Contractor's statement as a condition of employment on the contract.

2.58 BUILDING PERMIT AND OTHER PERMITS

The Building permit shall be obtained and paid for by the Owner. All other required permits are the responsibility of the Contractor to obtain. Fees for all other required permits shall be reimbursed to the Contractor at actual cost when the County is presented with a valid receipt.

2.59 CODES AND REGULATIONS

All work, materials and equipment shall be in full compliance with the California Building Code; California Plumbing Code; California Electrical Code; California Mechanical Code; California Fire Code; California Energy Code; as those codes may be amended from time to time; Cal/OSHA Safety Regulations; and all Federal, State and Local laws, ordinances, regulations and Fresno County Charter provisions in effect and applicable in the performance of the work.

END OF SECTION

SECTION 01 33 23 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Mill Certificates, Samples, and other miscellaneous submittals.

1.3 DEFINITIONS:

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

1.4 SUBMITTAL PROCEDURES:

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities and identify on project construction schedule the expected submittal dates and submittal return date.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Processing Time: Allow enough time for submittal review, including time for re-submittals, as follows. Time for review shall commence on the Architect's receipt of submittal.
 - 1. Initial Review: Allow five working days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals.
 - 2. Concurrent Review. Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow ten working days for initial review of each submittal. It is the Contractor's responsibility to track his submittals and notify the Project Manager of submittals not returned to the Contractor within the time specified herein.
 - 3. Allow five working days for processing each resubmittal.
 - 4. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

The Contractor, in preparing his work schedule, shall allocate time for at least one re-submittal for each submitted item.

- C. Identification: Place a permanent label or title block on each submittal for identification.
 - 1. Indicate name of firm or entity that prepared each submittal on label or title block.
 - 2. Provide a space on label or beside title block to record Contractor's review and approval markings and action taken by Architect (approximately 3" by 3" for Architects approval markings).
 - 3. Include the following information on label for processing and recording action taken:
 - a. Project name
 - b. Date
 - c. Name and address of Owner
 - d. Name and address of Contractor
 - e. Name and address of subcontractor
 - f. Name and address of supplier
 - g. Name of manufacturer
 - h. Unique identifier, including revision number
 - i. Number and title of appropriate Specification Section
 - j. Drawing number and detail references, as appropriate
- D. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- E. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
 - 1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
 - 2. On each submittal include Contractor's certification stating that information submitted has been reviewed, complies with requirements of the Contract Documents, and has been coordinated with other related portions of the Work.
 - 3. Transmittal Form: Provide locations on form for the following information:
 - a. Project name
 - b. Date
 - c. Destination (To:)
 - d. Source (From:)
 - e. Names of subcontractor, manufacturer, and supplier
 - f. Category and type of submittal
 - g. Submittal purpose and description
 - h. Submittal and transmittal distribution record
 - i. Remarks
 - j. Signature of transmitter
- F. 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.

- G. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS:

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
 - 1. Number of Copies: Submit six copies of each submittal, unless otherwise indicated. Architect through Project Manager will return two copies. Mark up and retain one returned copy as a Project Record Document. Submit one additional copy for operation and maintenance manuals as required by other sections of these specifications.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations
 - b. Manufacturer's product specifications
 - c. Manufacturer's installation instructions
 - d. Full selection color charts
 - e. Manufacturer's catalog cuts
 - f. Wiring diagrams showing factory-installed wiring
 - g. Printed performance curves
 - h. Operational range diagrams
 - i. Mill reports
 - j. Standard product operating and maintenance manuals
 - k. Compliance with recognized trade association standards
 - l. Compliance with recognized testing agency standards
 - m. Application of testing agency labels and seals
 - n. Notation of coordination requirements
- C. Samples: Prepare physical units of materials or products, including the following:
 - 1. 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.

2. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:
 - a. Generic description of Sample
 - b. Product name or name of manufacturer
 - c. Sample source
 3. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:
 - a. Size limitations
 - b. Compliance with recognized standards
 - c. Availability
 - d. Delivery time
 4. Number of Samples for Initial Selection: Submit two full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect through Construction Inspector will return submittal with options selected.
- D. Contractor's Construction Schedule: At minimum, submit an updated Contractor's Construction Schedule at monthly intervals.

2.2 INFORMATIONAL SUBMITTALS:

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit three copies of each submittal, unless otherwise indicated. Architect will not return copies.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of Contractor, testing agency, or design professional responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of the company.
 3. Test and Inspection Reports: Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service. Tests and Inspection Reports are to be performed by a testing agency with experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548.
- B. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
- D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

- E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
- F. Mill Certificates: provide testing data regarding the fabrication and strength of metal products. Mill Certificates shall be less than 1 year old.
- G. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- H. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
- I. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.
- J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- K. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization
 - 2. Date of evaluation
 - 3. Time period when report is in effect
 - 4. Product and manufacturers' names
 - 5. Description of product
 - 6. Test procedures and results
 - 7. Limitations of use
- L. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- M. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
 - 1. Preparation of substrates
 - 2. Required substrate tolerances
 - 3. Sequence of installation or erection
 - 4. Required installation tolerances
 - 5. Required adjustments
 - 6. Recommendations for cleaning and protection

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW:

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

3.2 ARCHITECT'S ACTION:

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows (or similar terminology):
 - 1. No exceptions taken
Proceed as shown
 - 2. Make corrections noted
Proceed making minor corrections noted
No resubmittal is required
 - 3. Submit specified item
Resubmittal required
 - 4. Revise and resubmit
Resubmittal required
 - 5. Rejected
Resubmittal required
- C. Informational Submittals: Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect and Inspector of Record will forward each submittal to appropriate party.
- D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION

SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

- A. This Section specifies requirements for temporary facilities and controls, including utility, construction and support facilities, and security and protection. Furnish and install all required temporary facilities and controls as shown or specified herein plus such facilities as required for proper performance of the Contract. All such temporary facilities and controls shall be located where directed and re-located as required by the progress of the work and maintained in a safe and sanitary condition at all times until completion of the Contract.
- B. Contractor shall be responsible for all of its own office and construction utilities including the cost of permits, usage, generation, installation, relocation, distribution, metering, maintenance, safety, disposal, and removal. Coordinate this work with the Project Manager.
- C. Coordinate installation and removal of temporary utilities with Project Manager, utility companies, other contractors, and authorities having jurisdiction. Contractor shall submit plans to the Project Manager for approval of proposed temporary utilities and facilities.
- D. Do not install or remove any temporary utility without prior written approval by Project Manager. Project Manager's written approval does not guarantee or warrant that utilities installed by the Contractor will not require relocation in the future due to the follow-on and/or sequence of work by Contractor or other contractors or by changes in scope and sequence of work by the Owner.
- E. Temporary utilities placed underground shall be permanently marked as to prevent damage by others, and accurately located for removal. Damage to above ground and underground utilities by the Contractor or others shall be repaired or replaced by the Contractor at not cost to the Owner.
- F. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution
 - 2. Electric power service
 - 3. Lighting
 - 4. Telephone service
- G. Support facilities include, but are not limited to, the following:
 - 1. Project identification and temporary signs
 - 2. Waste disposal facilities
 - 3. Temporary heat and ventilation
 - 4. Field offices and storage boxes

5. Sanitary facilities, including drinking water
 6. Temporary enclosures, fencing and barricades
 7. Construction aids and miscellaneous services and facilities
 8. Storm water control and drainage
- H. Security of the buildings shall be maintained at all times. Security and protection facilities include, but are not limited to, the following:
1. Environmental protection
 2. Security enclosure and lockup
 3. Temporary fire protection
 4. Barricades, warning signs, lights
 5. Shoring and scaffolding
- I. Removal of Temporary Facilities
1. Remove temporary facilities and controls, including associated materials and equipment, when their use is no longer required.
 2. Restore and recondition areas of the site damaged and disturbed by temporary facilities and controls and their installation.
 3. Remove and properly dispose of debris resulting from removal and reconditioning operations.
- J. Submittals
1. Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.
 2. Implementation and Termination Schedules: Submit a schedule indicating implementation of each temporary utility within 15 days of the date established for commencement of the Work.
- 1.3 USE CHARGES:
- A. General: Cost or use charges for temporary facilities are not chargeable to Owner, Project Manager or Architect and shall be included in the Contract Sum. Contractor shall be responsible for his/her own temporary power and for coordination with Pacific Gas and Electric Company (PG&E) for that temporary power service. Multiple temporary power services to the site may be required due to availability of power. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
1. Owner's Representatives
 2. Inspection and/or Testing agencies
 3. Personnel of authorities having jurisdiction
- 1.4 QUALITY ASSURANCE:
- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:
1. Building Code requirements
 2. Health and safety regulations
 3. Utility company regulations
 4. Police, Fire Department and Rescue Squad rules
 5. Environmental protection regulations.

- B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."
 - 1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
 - 2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70 and applicable codes.
 - 3. Refer to Guidelines for Bid conditions for Temporary Job Utilities and services prepared jointly by AGC and ASC for industry recommendations.
- C. 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. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
 - 1. Keep temporary services and facilities clean and neat
 - 2. Relocate temporary services and facilities as required by progress of the Work
 - 3. Operate in a safe and effective manner
 - 4. Take necessary fire prevention measures
 - 5. Do not overload facilities, or permit them to interfere with progress
 - 6. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the Site.
 - 7. Allow free use and access of all utilities at all times to all entities contracted to perform the Work.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by the Project Manager. Provide materials suitable for use intended. Provide specified utility services required during construction and extend temporary service lines to construction areas to allow use by all trades, and subcontractors.
- B. Paint: Comply with requirements in Section 09 90 00 "Painting"
 - 1. For sign panels and applying graphics, provide exterior grade alkyd glass enamel over exterior primer.
- C. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame spread rating of fifteen (15) or less. For temporary enclosures provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.
- D. Water: Provide potable water approved by local health authorities.

- E. For fences and vision barriers, provide exterior type, minimum 3/8" thick plywood.
 - 1. For safety barriers, sidewalk bridges and similar uses provide minimum 5/8" thick exterior plywood.

2.2 EQUIPMENT:

- A. General: Provide equipment and materials suitable for use intended.
- B. Field Offices: Provide mobile units with lockable entrances, operable windows, serviceable finishes, heated, air conditioned and on foundations adequate for normal loading. Comply with all applicable codes and requirements.
- C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- D. Temporary Toilet Units: Provide a sufficient number of self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material. Units shall be accompanied by hand washing stations, including paper towels and covered trash receptacles in accordance with governing regulations.
- E. Drinking-Water Fixtures: Containerized, bottled-water drinking-water units, including paper cup supply.
 - 1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7.2 to 12.7 deg C).
- F. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- G. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.
- H. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress.
- I. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where fixtures are exposed to breakage. Provide exterior fixtures where exposed to moisture.
- J. Trash removal: The Contractor shall be responsible for providing trash receptacles. He/she shall be responsible for the removal of debris from the job site and shall keep all work areas and passageways in and around the project free from debris. Collect waste from construction areas daily. Comply with requirements of NFPA 241 for

removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than seven (7) days during normal weather or three (3) days when the temperature is expected to rise above eighty (80) deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner. Owner trash facilities may not be used. If, in the Project Manager's opinion, the Contractor has not performed due diligence in keeping the site clean on a weekly basis, monies will be withheld from the Contractor's monthly progress payment in the maximum amount of \$1,000.00 per weekly occurrence. This notification will come from the Project Manager in writing. These accumulated monies will be released to the Contractor in the Contractor's next pay application upon verification by the Project Manager that the site has been cleaned.

- K. First Aid Supplies: Comply with governing regulations.
- L. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses one hundred feet long (100'), with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL:

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

3.2 TEMPORARY UTILITY INSTALLATION:

- A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials, and equipment. Comply with utility company recommendations.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 - 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
 - 4. Arrange with electric utility service company to provide service for power and lighting for temporary field offices. Pay costs for service and power used.
 - 5. Distribute electric power and lighting.
 - 6. Provide lighting and convenience outlets in the temporary structures, and as otherwise required for the performance of the Work.

7. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Project Manager, change over from use of temporary service to use of the permanent service.
 8. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.
- B. Water Service:
1. Contractor may connect to existing water point of connection for their use. Contractor is responsible for flushing and sterilizing new and existing piping prior to connection. Owner is not responsible for any damage to Contractors system or equipment due to inadequate flushing or sterilization of existing piping.
 2. Provide water for construction purposes.
 3. Install branch piping with taps located so that water for demolition, grub, clear, compaction, and construction purposes is available throughout the Work by the use of hoses. Protect piping and fitting against freezing.
 4. Make potable water available for human consumption.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
1. Locate as approved by the Project Manager.
 2. Provide containers to remove and dispose of effluent off the site in a lawful manner.
- D. Electric Power Service: Contractor may tap into site electrical service at the existing Warehouse or Shade Structure Building. Contractor must install power meter for monitoring construction power.
- E. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment in quantity, size, and type acceptable for each phase of the Work.
- F. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities.
1. Provide one telephone and one facsimile machine (FAX) in each Contractor's field office and pay costs for installation, maintenance, service, and removal.
- 3.3 SUPPORT FACILITIES INSTALLATION:
- A. General: Comply with the following:
1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities as directed by the Project Manager.
 2. Provide noncombustible construction for offices, shops, and sheds located within thirty (30) feet of building lines. Comply with NFPA 241.

3. Maintain support facilities until Completion as necessary. Remove upon completion of the Contractor's final contract milestone and written approval by the Project Manager. Personnel remaining after Notice of Completion may be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Heat and Ventilation: Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy. Provide forced ventilation of enclosed areas for proper installation and curing of materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors, and gases. Pay the costs of installation, maintenance, operation, and removal of temporary heat and ventilation, including costs for fuel consumed, required for the performance of the Work.
 - C. Storage and Fabrication Sheds: Install storage and fabrication sheds, sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within the designated building site.
 - D. Toilets: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented, and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material. Units shall be accompanied by hand washing stations, including paper towels and covered trash receptacles in accordance with governing regulations.
 1. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.
 - E. Drinking Water Fixtures: Provide drinking water as required by OSHA, including paper supply.
 - F. Temporary Enclosures: Provide temporary enclosures for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.
 1. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of twenty-five (25) square feet or less with plywood or similar materials.
 2. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with venting and material drying and curing requirements to avoid dangerous conditions and effects
 - G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste.
 1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.

2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION:

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until requested by the Project Manager.
- B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities, including but not limited to, water truck or water storage tank, fire hoses, nozzles and fire extinguishers. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one (1) extinguisher for every seventy-five (75') of travel.
 2. Store combustible materials in containers in fire-safe locations.
 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 4. Provide fire extinguisher access and supervision welding operations and similar sources of fire ignition.
 5. Provide water truck or other means to provide temporary fire protection until such time as permanent fire protection is in service.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs and Lights: Comply with standards and code requirements for the erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public, of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.
- E. Environmental Protection:
 1. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result.
 2. Avoid use of tools and equipment which produce harmful noise.
 3. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons in or near the site.
 4. Erosion and Sediment Control: Prepare and implement a comprehensive erosion and sediment control program. Perform daily cleanup of mud and dust carried onto street surfaces by construction vehicles. Throughout

excavation, haul trucks shall use tarpaulins or other effective covers. Upon completion, use effective measures to reduce wind erosion. Perform replanting and repaving operations as soon as practicable after site grading.

5. Air Quality / Dust Control:

- a. Indoor Operations: Control dust resulting from indoor construction operations by localizing it to greatest possible extent using temporary partitions, curtains, or other means which will prevent spread of dust beyond immediate work area. Duct openings and other openings communicating with other parts of building shall have effective temporary closures.
 - b. Outdoor operations: Provide dust control as required to abate any dust nuisance on or adjacent to Project Site. Apply water by means of approved sprinkling equipment, water wagons, or spray from hoses to extent and amount required at any time that dust control is necessary, as determined by the City, County, or Project Manager. Use of chemicals, oil or other such materials will not be permitted.
- F. Provide and maintain suitable temporary barriers as required to prevent public entry; protect the work and existing facilities, persons, and trees and plants from damage or injury from construction operations.
- G. Preserve and protect existing trees, irrigation, all landscaping, and plants not designated or required to be removed, and those adjacent to the site. As required, provide barriers to a minimum height of 6'-0" around each tree and plant, or around groups in proximity of construction operations.

3.5 CLEANING DURING CONSTRUCTION:

- A. Contractor shall dispose of all material off-site, in a lawful manner. Do not allow the accumulation of scraps debris, waste material and other items not required for construction of this work. Remove waste materials and rubbish not less than on a weekly basis and dispose of at Contractor's expense.
- B. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.
- C. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.
- D. Each sub-contractor shall clean up the results of his/her work and deliver such debris to areas designated for holding by Prime Contractor.
- E. Weekly, and more often if necessary, sweep all interior spaces clean. "Clean", for the purpose of this sub-paragraph, shall be interpreted as meaning free from dust and other materials capable of being removed by reasonable diligence using a hand-held broom.
- F. Following the installation of finish floor materials, clean the finish floor and provide adequate protection. Inspect protection daily (or more often if necessary) while work is being performed in the space in-which finish materials have been installed. "Clean", for the purpose of this sub-paragraph, shall be interpreted as meaning free from all

foreign materials which, in the opinion of the Project Manager or Architect, may be injurious to the finish floor material.

3.6 OPERATION, TERMINATION AND REMOVAL:

- A. Maintenance: Maintain facilities in good operating condition until removal. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a twenty-four (24) hour/day basis where required to achieve indicated results and to avoid the possibility of damage.
- B. Termination and Removal: Unless the Project Manager requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by the authorized use of a permanent facility, or no later than the Final Billing. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the 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 the Contractor. The Owner reserves the right to take possession of the Project identification signs.
 - 2. Prior to Notice of Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
 - a. Replace air filters and clean the inside of ductwork and housings.
 - b. Replace significantly worn parts and parts that have been subject to unusual operating conditions as determined by the Project Manager.
 - c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

3.7 TREE AND PLANT PROTECTION

- A. Preserve and protect existing trees, plants and grapevines which are not designated or required to be removed, and those adjacent to the site.
- B. Consult with the Project Manager prior to removal of roots and branches which interfere with demolition and construction operations. Remove only those items agreed upon in writing with the Project Manager.
- C. Provide barriers to a minimum height of 6' around each tree and plant, around each group of trees and plants, as applicable, in the proximity of demolition and construction operations.
- D. In the proximity of root zones of trees and plants:
 - 1. Prohibit vehicular traffic and parking.
 - 2. Prohibit storage of materials and equipment.
 - 3. Prevent dumping of refuse and chemically injurious materials and liquids.
 - 4. Prevent puddling and continuous running water.
- E. Carefully supervise excavating, grading, and filling, and subsequent construction operations, to prevent damage.

- F. At no increase in Contract Sum, replace, or suitably restore trees and plants designated to remain which are damaged or destroyed as a result of demolition and construction operations.
- G. Remove and lawfully dispose of soil that has been contaminated during the performance of the Work by oil, solvents, and other materials which could be harmful to trees and plants, and replace with good soil, at no increase in Contract Sum. Provide manifests for removed soil to Project Manager.

3.8 SECURITY

- A. Secure, maintain, and protect the Work, stored materials, equipment, and temporary facilities until time of Final Completion, or such earlier time as Owner may choose to assume such responsibility.
- B. Security and protection may be by any legal method, or combination of methods, acceptable by the Project Manager.

3.9 TEMPORARY CONTROLS

A. Noise and Vibration:

1. Equipment and impact tools shall have intake and exhaust mufflers.
2. Secure written permission from the Project Manager at least three (3) working days prior to using noisy and vibratory equipment, such as jackhammers, concrete saws, impact tools, and high-frequency electrical equipment.
3. Cooperate with the Owner and/or Project Manager if the use of noisy and vibratory equipment becomes objectionable by its longevity.

B. Dust and Dirt:

1. Conduct demolition and construction operations to minimize the generation of dust and dirt and prevent dust and dirt from interfering with the progress of the Work and from accumulating in Work and adjacent areas.
2. To additionally minimize the generation of dust and dirt, hauling equipment and trucks carrying loads of soil and debris shall have their loads sprayed with water or covered with tarpaulins.
3. Prevent dust and dirt from accumulating on walks, roadways, parking areas, and planting, and from washing into sewer and storm drain lines.
4. Periodically water exterior demolition and construction areas to minimize the generation of dust and dirt.

C. Water: Do not permit surface and subsurface water and other liquids to accumulate in or about the Project site and vicinity thereof. Should such conditions develop, control the water or other liquid, and suitably dispose of it by means of temporary pumps, piping, drainage lines, troughs, ditches, dams, or other methods.

D. Pollution:

1. No burning of refuse, debris, or other materials shall be permitted on or in the vicinity of the Project site.
2. Comply with applicable regulatory requirements and anti-pollution ordinances during the conduct of construction and disposal operations.

- E. Pest Control: Take necessary provisions to control rodents, insects, and other pests.

3.10 PROJECT IDENTIFICATION AND SIGNS

- A. General:

1. Contractor shall have provisions in their contract to provide a 4'-0" x 8'-0" project identification sign with graphics and verbiage given to them by the Project Manager. No other language or graphics will be permitted the sign other than what is approved by the Project Manager. Contractor shall construct and maintain, at the Contractor's cost, this identification sign throughout the entire course of the project. Location of the sign will be provided by the Project Manager.
2. Signs other than the specified Project sign will not be permitted, unless otherwise approved in advance by the Project Manager. No Contractor signs or banners are allowed on the temporary fence.

3.11 SITE CONTROLS AND PARKING

- A. Entrance to Work Site: Contractor and his/her employees shall use certain access roads or entrances as indicated on attached drawing or as directed by Construction Manager. Maintain these roads in satisfactory condition during Contract time, and repair damages attributable to Work of this Project at intervals as needed. At completion of Contract, roads and entrances shall be left in condition at least equal to that existing at start of Contract, except as may be otherwise required by Contract Documents.
- B. Site Storage and Work Areas: Project Manager will allocate available on-site storage and work areas to Contractor, subject to change as may be necessary by job progress such as site development or other intervening Work.
- C. Regulations: Observe and comply with rules and regulations in effect at occupied facilities, including, but not restricted to, parking and traffic regulations, security restrictions, hours of access, etc.
- D. Use of Public Sidewalks and Streets: Make arrangements with local authorities including Traffic Engineer, for temporary use of streets and sidewalks for offices, shops, storage, etc. Abide by County rules, regulations, and ordinances. Obtain permits and pay all required fees.

END OF SECTION

SECTION 01 77 19 – PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General Conditions and other Division 01 General Requirements, apply to this Section.

1.2 SUMMARY:

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
 - 1. Inspection procedures
 - 2. Project record document submittal
 - 3. Operation and Maintenance Data
 - 4. Instruction of Owner's personnel
 - 5. Service and maintenance contracts
 - 6. Submittal of guarantees/warranties and bonds
 - 7. Final Cleaning
 - 8. Restoration of damaged and remedial work
 - 9. Delivery of extra materials
- B. Process individual buildings, site package and landscape package separately for project closeouts.

1.3 FINAL COMPLETION:

- A. Preliminary Procedures: Before requesting inspection for certification of Final Completion, complete the following. List exceptions in the request.
 - 1. In the Application for Payment that coincides with, or first follows, the date Final Completion is claimed, show 100 percent (100%) completion for the portion of the Work claimed as complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of charges to the Contract Sum.
 - a. If 100 percent (100%) completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - 2. Advise Project Manager of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
 - 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
 - 5. Complete final clean up requirements, including touch-up painting. Touch up and otherwise repair and restore marred exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, the Project Manager will either proceed with inspection scheduling or advise the Contractor of unfilled requirements. The Project Manager will prepare the Notice of Completion following

inspection or advise the Contractor of construction that must be completed or corrected before the Notice will be issued.

1. The Project Manager will repeat inspection scheduling when requested and assured that the Work has been completed.
2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE:

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Project Manager's and Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Project Manager and Architect.
4. Submit record drawings, damage or settlement survey, property survey, and similar final record information.
5. Submit consent of surety to final payment.
6. Submit a final liquidated damages settlement statement.
7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Re-inspection Procedure: The Project Manager will re-inspect the Work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Project Manager.

1. Upon completion of re-inspection, the Project Manager will prepare a Notice of Completion, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final completion.
2. If necessary, the re-inspection procedure will be repeated.

1.5 RECORD DOCUMENT SUBMITTALS:

A. General: Do not use record drawings for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Owner, Project Manager and Architect reference during normal working hours.

B. Record Drawings: Maintain clean undamaged set of prints of Contract Drawings and Shop Drawings. Mark the set in the manner approved in advance by the Project Manager to show the actual installation where the installation varies from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

Label each document "PROJECT RECORD" in large, neat, printed letters. Failure to maintain record drawings shall result in withholding of Contractor's payment. See provisions in Section 2.24 – Payment, located in the General Conditions.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
 2. Mark information that is important to the Owner, but was not adequately shown on Contract Drawings or Shop Drawings.
 - a. Changes made by Change Order and other modifications described in the GENERAL CONDITIONS noting the change or modification source.
 - b. Locations of significant Work concealed inside the building whose general locations have been changed from those shown on the Contract Documents
 - c. Locations of items, not necessarily concealed, which have been changed, with the Architect's prior written approval, from the location shown on the Contract Documents.
 - d. Revisions to routing of piping and conduit.
 - e. Revisions to electrical circuitry.
 - f. Actual equipment locations.
 - g. Ducting Size and routing.
 3. Note related Change Order or Work Authorization number where applicable.
 4. Organize Record Drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on cover of each set.
 5. Keep up to date during entire progress of the Work, and furnish additional drawings as necessary for clarification. Failure to maintain record drawings shall result in withholding of Contractor's payment. See provisions in Section 2.24 – 'Payment', located in the General Conditions.
 6. Record deviations from the sizes, locations, and other features of installations shown in the Contract Documents.
 7. Establish locations of underground Work by Global Positioning Systems (GPS) and reference invert elevations and rates of fall.
 8. Give sufficient information to locate Work concealed in the building.
 9. Locate main runs of piping, conduit, ductwork and similar items by dimensions.
 10. Locate other items either by dimensions or in relation to spaces within the building.
 11. Where feasible, the individual or entity that obtained record data, whether the individual or entity is the installer, subcontractor, or similar entity, is required to prepare the mark-up on Record Drawings.
 12. Accurately record information in an understandable drawing technique.
 13. Record data as soon as possible after it has been obtained. In the case of concealed installation, record and check the mark-up prior to concealment.
- C. As-Built Drawings:
1. At time of acceptance of the Work and prior to final payment, using the record drawings for reference, prepare "As-Built" drawings on permanent, transparent, reproducible prints furnished by the Architect. Furnish reproducible record drawings, made from final Shop Drawings, which have

been updated to show actual conditions, for Work specified in the individual Specification sections. Where Shop Drawings are marked, show cross-reference on "As Built" Drawings.

- a. Employ and pay a professional draftsman to prepare the "As-Built" drawings from the record drawings, using typical drafting devices and recording information in ink clouding all changes.
- b. After completing the preparation of transparency record drawings, produce three (3) copies of each Drawing, whether or not changes and additional information were recorded. Organize the copies into manageable sets. Bind each set with durable paper cover sheets, with appropriate identification, including titles, dates and other information on cover sheets.
- c. Organize and bind original marked-up set of prints that were maintained during the construction period in the same manner.
- d. Organize record mylar transparencies into sets matching the print sets. Reverse roll and place these sets in durable tube-type Drawing containers with end caps. Mark the end cap of each container with suitable identification.
- e. Sign and date the completed Project "Record Drawings" and transmit them to the Construction Manager, who will forward them to the Owner after final acceptance of the Work.

D. Large-Scale Coordination Drawings:

1. The preparation of large-scale, detailed coordination drawings will be required for the Work of Divisions 22, 23, 25, 26, 27, 28 and 31 of these Specifications. These coordination drawings are not Shop Drawings as defined by the General Conditions, but, together with Shop Drawings or coordination drawings of other affected Work, are used to check, coordinate, and integrate the various types of Work.
2. If furnished, include the coordination drawings as part of the Project "Record Drawings".

E. Record Drawing Construction Schedule:

1. Using as a basis the latest, updated Progress Schedule required by Section 013323 "Submittal Procedures," prepare and transmit a Record Construction Schedule to indicate the actual dates and durations of the various construction activities.

F. Record Specifications: Maintain one (1) complete copy of the Project Manual, including addenda, and one (1) copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in the actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

1. Mark each Specification SECTION to record:
 - a. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually incorporated in the Work.
 - b. Changes made by Change Order and other modifications described in the GENERAL CONDITIONS

- G. Operation and Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data into individual heavy-duty 2-inch, 3-ring vinyl-covered binder, with pocket folders for folded sheet information. Mark the appropriate identification on front spine of each binder. Provide index near front of binder furnishing immediate information as to locations in the manual of all emergency data regarding the equipment included in the manual. Provide entire contents of Binder on a USB storage device organized in same sequence as binder.
1. Include the following types of information:
 - a. Emergency instructions
 - b. Spare parts list
 - c. Copies of warranties
 - d. Wiring diagrams
 - e. Recommended maintenance schedules and a list of maintenance performed during the construction process.
 - f. Inspection procedures
 - g. Shop drawings and product data
 - h. Fixture lamping schedule.
 - i. Complete nomenclature of replaceable parts, their part numbers, current cost and name and address of nearest source of parts.
 - j. Copy of each guarantee/warranty and service contract issued for the equipment included in the manual.
 - k. Delete Extraneous Data from manufacture's catalog pages, information, which is not applicable to this project installation.
 - l. Video tape of Training Procedures
 2. Submittal Schedule: Comply with the following schedule for submittal of operating and maintenance manuals.
 - a. Before submittal of Request for Final Payment, when each installation that requires submittal of operating and maintenance manuals is nominally complete, submit two (2) draft copies of each manual to the Construction Manager for review. Include a complete index or table of contents.
 - b. The Construction Manager will return one (1) copy of the draft with comments within fifteen (15) days of receipt.
 - c. Submit one (1) copy of the manuals in final form at least fifteen (15) days before final inspection. This copy will be returned within fifteen (15) days after Final Inspection, with comments.
 - d. After final inspection, make corrections or modifications to comply with the Construction Manager's comments. Submit the specified number of copies of each approved manual to the Construction Manager within fifteen (15) days of receipt of Construction Manager's comments
- H. Operation Tests
1. Conduct systematic start-up and operational tests as required to demonstrate that all systems have been completed and are in compliance with all requirements of the Contract Documents and are fully functioning and operational. Contractor shall coordinate his/her start-up and operational tests with contractors performing work under other bid packages.

2. Furnish a written record of test results using recording type instruments where applicable
- I. Upon completion of the Work, submit Close out Documents to the Project Manager for the Owner's records.
- J. Transmit manuals in the quantity, which is required to be returned, plus the following, unless otherwise specified, which will be retained by the Project Manager for forwarding to the Owner after acceptance of the work.
 1. Two (2) copies of Mechanical and Electrical manuals and one (2) electronic copies on a USB storage device.
 2. Two (2) copies of all other manuals and one (2) electronic copies on a USB storage device.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES:

- A. Owner's Training Sessions: Arrange for each installer of equipment that requires regular maintenance to provide DVD-recorded Owner's training sessions. Arrange for each installer of equipment that requires regular maintenance, to meet with the Owner's personnel to review contractor furnished DVD-recorded instruction in the proper operation and maintenance of each component of each system. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
 1. Maintenance manuals
 2. Record documents
 3. Spare parts and materials
 4. Tools
 5. Lubricants
 6. Fuels
 7. Identification systems
 8. Control sequences
 9. Hazards
 10. Cleaning
 11. Warranties, bonds
 12. Maintenance agreements and similar continuing commitments
- B. As part of instruction for operating equipment, demonstrate the following procedures:
 1. Start-up
 2. Shut-down
 3. Emergency operations
 4. Noise and vibration adjustments
 5. Safety procedures
 6. Economy and efficiency adjustments
 7. Effective and energy utilization.

- C. Schedule training to conform to personnel availability at the facility and to conclude prior to start up of system. The base duration of training shall be determined by the complexity of the system or equipment and shall be done by qualified instructors from the manufacturer or contractor.
- D. As part of the operator's training, one (1) lesson plan shall be devoted to reviewing of DVD, which shall be incorporated into the training program to allow new employees to view the DVD at their own convenience and be able to comprehend the system without the need for an instructor in attendance.
- E. Prepare one (1) set of DVD's to assist maintenance personnel in trouble-shooting the systems and making routine repairs. All DVD's shall be made at the Project facility to ensure that the video portrayal is representative of the true systems.
- F. In addition to written technical descriptions, the training shall lay out prescribed hands-on-training under the supervision of others who have previously completed the training program. The foregoing techniques are to be developed to produce a program that is self-perpetuating and permits a high level of operator training in the event of high turnover rates among those who are assigned to duties in maintenance.

3.2 FINAL CLEANING:

- A. General: General cleaning during construction is required by the General Conditions and included Section "Temporary Facilities and Controls".
 - 1. Comply with applicable regulatory requirements during the cleaning and disposal operations. Special cleaning requirements for specific elements of the Work are included in appropriate Sections of Division 3 through 50.
 - 2. Use cleaning materials, which will not create hazards to health or property or cause damage to products or Work. Conduct cleaning and waste disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.
 - 3. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to a condition acceptable to the Construction Manager. Use cleaning materials and methods recommended by the manufacturer of the products to be cleaned.
 - 4. Schedule operations with sufficient time for surfaces to dry thoroughly to prevent dust, and other contaminants resulting from cleaning operations from adhering to wet or newly finished surfaces.
 - 5. Complete the following cleaning operations before requesting inspection for Certificate of Completion.
 - a. Remove labels that are not permanent labels.
 - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable as vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, grease, fingerprints, labels, spills, spatters, films, and similar foreign substances. Restore reflective surfaces to their original reflective condition. Mop clean concrete floors. Vacuum carpeted surfaces.

- d. Wipe surfaces of mechanical and electrical equipment, elevator equipment and similar equipment. Remove excess lubrication, paint, mortar droppings and other foreign substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps, vacuum inside of electrical panels and cabinetwork.
 - e. Clean the Site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
 - f. Clean permanent filters and replace disposable filters of units operated during construction.
 - g. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - h. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - i. Touch up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or show evidence of repair or restoration. Do not paint over "UL" and similar labels including mechanical and electrical nameplates.
6. Pest Control: Engage an experienced exterminator to make a final inspection, and to rid Project of rodents, insects, and other pests.
7. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
8. Compliances: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
9. Materials remaining after completion of associated Work shall be disposed of or stored as directed by the Construction Manager.

END OF SECTION

SECTION 017836 – WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General Conditions and other Division 01 General Requirements, apply to this Section.

1.2 SUMMARY:

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties. Contractor will review guarantee/warranty and bonds to verify compliance with Contract Documents.
 - 1. Refer to Article 2.32 of the General Conditions and Section 006536 "Guaranty."
 - 2. General closeout requirements are included in Section 017719 "Project Closeout."
 - 3. Specific requirements for warranties of the Work and products and installations that are specified to be warranted, are included in the individual Sections of Division 03 through Division 49. If no specific information is included in individual sections of the specifications, warranty period shall be as follows: Manufacturer's warranties notwithstanding, warrant the entire Work against defects in materials and workmanship for three hundred sixty-five (365) calendar days from date of Notice of Completion.
 - 4. Certifications and other commitments and agreements for continuing services to the Owner are specified elsewhere in the Contract Documents.
 - 5. The Contractor will not be responsible for defects due to misuse, negligence, willful damage, improper maintenance, or accident caused by others, nor shall he be responsible for defective parts whose replacement is necessitated by failure of the Owner's maintenance forces to properly clean and service them, provided the Contractor has furnished complete maintenance instructions to the Owner.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 BOND REQUIREMENTS

- A. Refer to Article 2.36 of the General Conditions

1.4 DEFINITIONS RE: WARRANTIES:

- A. Standard Product Warranties are pre-printed written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.5 WARRANTY REQUIREMENTS:

- A. Related Damages and Losses: When correcting warranty Work that has failed, remove, and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranty Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Costs: Upon determination that Work covered by a warranty has failed, replace, or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.6 SUBMITTALS RE: WARRANTIES:

- A. Submit written warranties to the Project Manager upon request of the Construction Manager, and in any event prior to any request by Contractor for final acceptance of the Work. The commencement date for warranties applicable to the Work shall be the date of acceptance of the Work as specified in the Notice of Completion, unless otherwise noted in the Contract Documents (e.g., as to manufacturer's warranties for equipment).
 - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Project Manager within ten (10) days of completion of that designated portion of the Work.
 - 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

- B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier, or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Construction Manager for approval prior to final execution.
 - 1. Refer to individual Sections of Division - 03 through Division - 49 for specific content requirements, and particular requirements for submittal of special warranties.
 - 2. Submit the Guarantee/Warranty typed on the Contractor's letterhead if for the entire Work, or on the Subcontractor's letterhead if for the Work of a Specification Section.
 - C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - D. Bind warranties and bonds into heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper. Provide separate binders for each building, site and landscape package.
 - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the 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 the installer.
 - 2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.
 - 3. When operating and maintenance manuals are required for warrantied construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.
 - E. Time of Submittal
 - 1. Submit guarantees/warranties within ten (10) days after date of Notice of Completion, prior to request for Final Payment.
 - 2. For items of Work where acceptance is delayed materially beyond the date of Notice of Completion, furnish updated submittal within ten (10) days after such delayed acceptance, listing the date of delayed acceptance as the start of the guarantee/warranty period.
- 1.7 REVIEW MEETING:
- A. Eleven (11) months following date of acceptance of the Work, hold a meeting for the purpose of review of, and action upon, guarantees/ warranties, bonds, and service and maintenance contracts.
- 1.8 SERVICE AND MAINTENANCE CONTRACTS
- A. Compile, review, and transmit specified service and maintenance contracts as specified for guarantees/warranties and bonds.

1.9 PREPARATION FOR FINAL INSPECTION

- A. Perform final cleaning as specified hereinbefore.
- B. Assemble guarantees/warranties, service, and maintenance contracts, operating and maintenance instructions, and other items as specified, and transmit to the Project Manager, who will forward them to the Owner after final acceptance of the Work.

1.10 RESTORATION OF DAMAGED WORK

- A. Restore or replace, as specified, or determined by the Architect, material and finishes damaged from construction activities at no additional expense to the Owner.
- B. Restoration shall be equal to the original Work, and finishes shall match the appearance of existing adjacent Work.

1.11 REMEDIAL WORK

- A. Remedial Work necessary owing to faulty workmanship or materials shall be at no additional expense to the Owner.
- B. Work shall be coordinated with the Owner and performed at such time and in such manner to cause minimal interruption and inconvenience to the Owner's operations.

1.12 EXTRA MATERIALS

- A. Where required in the individual Specification SECTIONS, furnish extra materials in the quantities and manners specified. Prior to submitting any materials submit a list of all extra material required in the specification sections.
- B. Delivery and certification of such extra materials shall be a prerequisite to Notice of Completion.
- C. Deliver extra materials directly to Owner for sign-off.
- D. Package in clearly identifiable boxes.
- E. Indicate manufacturer's name, part name, and stock number.
- F. Indicate piece of equipment part or tool is for.
- G. Indicate name, address and phone number of closest supplier.

1.13 MISCELLANEOUS RECORD SUBMITTALS

- A. Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Immediately prior to Final Acceptance, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the Project Manager for the County's records.

ECC - EDUCATIONAL BUILDING
FRESNO, CA.

WARRANTIES AND BONDS
SECTION 017836 - 5

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION

SECTION 020100 - SUBSURFACE EXPLORATION

PART 1 - GENERAL

A. DESCRIPTION:

1. Soil and subsurface investigations may have been conducted in the past at the site by an independent testing laboratory and a log of borings prepared.
2. The report is obtained only for the Owner's use in foundation and parking area design and is not a part of the Contract Documents. The report and log of borings are available for the Contractor's information, but is not a warranty of the subsurface conditions. The Contractor may use a report at his own risk.
3. The Owner does not assume responsibility for variations in kind, depth, quantity and conditions of soils. The Owner disclaims responsibility for accuracy, true location, and extent of soils investigation that has been prepared by others; and it further disclaims responsibility for interpretation of that data by the Contractor as in projecting soil bearing values, rack profiles, soil stability, and presence, level and extent of underground water.
4. The Contractor should visit the site and acquaint himself with site conditions. Prior to bidding, the Contractor may make, at his expense, his own subsurface investigation to satisfy himself with site and subsurface conditions. The Contractor shall obtain authorization of the Owner prior to start of borings or subsurface investigations.
5. The Owner may retain a Soils Engineer to observe the performance of all work related to preparation, filling and compacting of soils under this Section or required by the Contract Documents. If, in the opinion of the Soils Engineer, any work performed under this Section does not meet the technical or design requirements stipulated for the work, make all necessary readjustments to his approval. No deviations from the Contract Documents shall be made without specific and written approval of the Soils Engineer or the Owner.
6. The Soils Engineer's review of the Contractor's performance does not include review of the Contractor's safety measures in, on, or near the jobsite or connected in any way with the performance of the work of this Section.

END OF SECTION 020100

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Form-facing material for cast-in-place concrete.

1.3 DEFINITIONS

- A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 PREINSTALLATION MEETINGS

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

- 1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction, movement, contraction, and isolation joints
 - c. Forms and form-removal limitations.
 - d. Anchor rod and anchorage device installation tolerances.

1.5 INFORMATIONAL SUBMITTALS

- A. Minutes of preinstallation conference.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and

dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
 - a. For architectural concrete specified in Section 033300 "Architectural Concrete," limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:
 - a. Plywood, metal, or other approved panel materials.
 - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA HDO (high-density overlay).
 - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
 - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
 - 4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class.

1. Provide forms with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

2.3 RELATED MATERIALS

A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

B. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

- C. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes .
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.

- I. Chamfer exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- L. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 3. Place joints perpendicular to main reinforcement.
 - 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
 - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 6. Space vertical joints in curbs and walls as indicated on Drawings .
 - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 - 2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Clean embedded items immediately prior to concrete placement.

3.3 REMOVING AND REUSING FORMS

- A. Formwork for sides of slabs, beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work.
 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
 1. Align and secure joints to avoid offsets.
 2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

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. Steel reinforcement bars.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .
 - 1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction contraction and isolation joints.
 - c. Steel-reinforcement installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of steel reinforcement.
 - 2. Bar supports.
- B. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Minutes of preinstallation conference.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - 1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 , deformed.

2.2 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

- a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
 - 1. Finish: Plain .

2.3 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
 - 2. Stagger splices in accordance with ACI 318.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
 - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.

- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

- B. Inspections:

- 1. Steel-reinforcement placement.

END OF SECTION 032000

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. It is understood that the finish material of the floors in this project are the concrete slab on grade. Therefore, concrete placement technique, finishing and curing among other items is of the utmost importance to the District for the final product.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: fly ash: materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Concrete Subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.

- C. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.
- D. Samples: For vapor retarder.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Fiber reinforcement.
 - 6. Curing compounds – Not Allowed.
 - 7. Floor and slab treatments.
 - 8. Bonding agents.
 - 9. Adhesives.
 - 10. Vapor retarders.
 - 11. Joint-filler strips.
 - 12. Repair materials.
- C. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- E. Field quality-control reports.
- F. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. 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."
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, 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.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

- D. Mockups: Cast concrete slab-on-grade panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
 - 1. Build panel approximately 200 sq. ft. for slab-on-grade in the location indicated or, if not indicated, as directed by Architect in the field.
 - 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 Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures. Trial batches are not the responsibility of the District.
- 1.9 DELIVERY, STORAGE, AND HANDLING
 - A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- 1.10 FIELD CONDITIONS
 - A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
 - B. Hot-Weather Placement: Comply with ACI 301 and as follows:
 - 1. 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 to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI 117.

2.2 FORM-FACING MATERIALS

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

1. Plywood, metal, or other approved panel materials.
 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
 3. Overlaid Finnish birch plywood.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.
- C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150/C 150M, Type II/V, gray.
 - 2. Fly Ash: ASTM C 618, Class F.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 1 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/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.
 - 7. Shrinkage Reducing Admixture: ASTM C157
- F. Water: ASTM C 94/C 94M and potable.

2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 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. Barrier-Bac; Inteplast Group, Ltd.
 - b. Fortifiber Building Systems Group.
 - c. GCP Applied Technologies Inc. (formerly Grace Construction Products).
 - d. Insulation Solutions, Inc.
 - e. Poly-America, L.P.
 - f. Raven Industries, Inc.
 - g. Reef Industries, Inc.
 - h. Stego Industries, LLC.
 - i. Tex-Trude, Inc.

2.7 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. 102 V-Seal Concrete Sealers, LLC.

- b. AWRC Corporation.
- c. BASF Corporation; Admixture Systems.
- d. ChemMasters, Inc.
- e. ChemTec Int'l.
- f. Concrete Sealers USA.
- g. Curecrete Distribution Inc.
- h. Dayton Superior.
- i. Euclid Chemical Company (The); an RPM company.
- j. Kaufman Products, Inc.
- k. L&M Construction Chemicals, Inc.
- l. Metalcrete Industries.
- m. Moxie International.
- n. NewLook International, Inc.
- o. Nox-Crete Products Group.
- p. PROSOCO, Inc.
- q. SpecChem, LLC.
- r. US SPEC, Division of US MIX Company.
- s. Vexcon Chemicals Inc.

2.8 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

2.9 RELATED MATERIALS

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

2.10 REPAIR MATERIALS

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

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

2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 15 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Aggregate combined grading shall be well graded.
- E. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use 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.
 - 3. Use Shrinkage Reducing admixture in concrete slabs on grade and concrete walls.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Normal-weight concrete.
 - 1. Minimum Compressive Strength: As indicated on Drawings at 28 days.
 - 2. Maximum W/C Ratio: As indicated on Drawings.
 - 3. Slump Limit: 4 inches, plus or minus 1 inch.
 - 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size, unless indicated otherwise on Drawings
- B. Lean Concrete: Normal-weight concrete.
 - 1. Minimum four (4) sack concrete mix.
 - 2. Maximum W/C Ratio: 0.50.
 - 3. Slump Limit: 5 inches, plus or minus 1 inch.
- C. Slabs-on-Grade: Normal-weight concrete.
 - 1. Minimum Compressive Strength: As indicated on Drawings at 28 days.
 - 2. Maximum W/C Ratio: As indicated on Drawings

3. Minimum Cementitious Materials Content: 520 lb./cu. yd.
4. Slump Limit: 4 inches, plus or minus 1 inch.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size, unless indicated otherwise on Drawings.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb./cu. yd.

2.13 FABRICATING REINFORCEMENT

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

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

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

- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of walls and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 36 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 12 inches and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.

3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

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

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 1. Apply to concrete surfaces not exposed to public view.

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

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 - 1. Apply scratch finish to surfaces indicated.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces indicated.

2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
 3. Finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft. long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

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

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture 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 for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
 3. Curing Compound: Not Allowed.
 4. Curing and Sealing Compound: Not Allowed.

3.12 LIQUID FLOOR TREATMENT APPLICATION

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than 28 days' old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least three month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

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

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

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 1. Steel reinforcement placement.
 2. Headed bolts and studs.
 3. Verification of use of required design mixture.
 4. Concrete placement, including conveying and depositing.
 5. Curing procedures and maintenance of curing temperature.
 6. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing 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 one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. 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 provides 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.
 3. 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.
 4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

6. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 7. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of three standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of three standard cylinder specimens for each composite sample.
 8. Compressive-Strength Tests: ASTM C 39/C 39M;
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. Test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - c. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 11. 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.
 12. 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.
 13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

3.16 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 033543 - POLISHED CONCRETE FINISHING

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 polished concrete finishing.
 - 1. Concrete for polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 033000 "Cast-in-Place Concrete."
- B. Related Requirements:
 - 1. Section 033000 "Cast-in-Place Concrete" for concrete not designated as polished concrete.

1.3 DEFINITIONS

- A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Cast-in-place concrete subcontractor.
 - e. Polished concrete finishing Subcontractor.
 - 2. Review **cold- and hot-weather concreting procedures, curing procedures, construction joints, concrete repair procedures, concrete finishing**, and protection of polished concrete.

1.5 ACTION SUBMITTALS

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

- B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.
- C. Samples for Initial Selection: For each type of product requiring color selection.
- D. Samples for Verification: For each type of exposed color.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Repair materials.
 - 2. Stain materials.
 - 3. Liquid floor treatments.

1.7 QUALITY ASSURANCE

- A. Field Sample Panels: After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches (1200 by 1200 mm) minimum, to demonstrate the expected range of finish, color, and appearance variations.
 - 1. Locate panels as indicated or, if not indicated, as directed by Architect.
 - 2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Demolish and remove field sample panels when directed.
- B. Mockups: Before casting concrete, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
 - 2. Demonstrate curing, finishing, and protecting of polished concrete.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 LIQUID FLOOR TREATMENTS

- A. Reactive Stain: Acidic-based stain with wetting agents and high-grade, UV-stable metallic salts that react with calcium hydroxide in cured concrete to produce permanent, variegated, or translucent color effects.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Americrete, Inc.
 - b. Artcrete, Inc.
 - c. Bomanite Co.
 - d. SureCrete Design Products, a Fenix Group SPC Company.
 - e. Or equal.
- B. Penetrating Stain: Water-based, acrylic latex, penetrating stain with colorfast pigments.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AmeriPolish.
 - b. Americrete, Inc.
 - c. Bomanite Co.
 - d. Or equal.
- C. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, water-borne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ARDEX Americas.
 - b. AWRC Corporation.
 - c. Advanced Floor Products.
 - d. AmeriPolish.
 - e. Or equal.

PART 3 - EXECUTION

3.1 POLISHING

- A. Polish: **Level 2: Low sheen, 400 grit.**
- B. Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.
1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.

2. Apply reactive stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
3. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
4. Apply penetrating stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
5. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
6. Control and dispose of waste products produced by grinding and polishing operations.
7. Neutralize and clean polished floor surfaces.

3.2 STAINING

- A. Newly placed concrete shall be at least **14** days old before staining.
- B. Prepare surfaces according to manufacturer's written instructions and as follows:
 1. Clean concrete thoroughly by scraping, applying solvents, or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
 - a. Do not use acidic solutions to clean surfaces.
 2. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by **grinding, sanding, or abrasive blasting**. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
 3. Apply acidic solution to dampened concrete surfaces, scrubbing with uncolored, acid-resistant nylon-bristle brushes until bubbling stops and concrete surface has texture of 120-grit sandpaper. Do not allow solution to dry on concrete surfaces. Rinse until water is clear. Control, collect, and legally dispose of runoff.
 4. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F 710 to ensure pH is between **7 and 8**.
- C. Scoring: Score decorative jointing in concrete surfaces 1/16 inch (1.6 mm) deep with diamond blades to match pattern indicated. Rinse until water is clear. Score **before** staining.
 1. Joint Width: **1/4 inch (6.35 mm)**.
- D. Allow concrete surface to dry before applying stain. Verify readiness of concrete to receive stain according to ASTM D 4263 by tightly taping 18-by-18-inch (450-by-450-mm), 4-mil- (0.1-mm-) thick polyethylene sheet to a representative area of concrete surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.
- E. Reactive Stain: Apply reactive stain to concrete surfaces according to manufacturer's written instructions and as follows:

1. Apply stain by uncolored bristle brush, roller, or high-volume, low-pressure sprayer and immediately scrub into concrete surface with uncolored, acid-resistant nylon-bristle brushes in continuous, circular motion. Do not spread stain after fizzing stops. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
 2. Remove stain residue after four hours by wet scrubbing with commercial-grade detergent recommended by stain manufacturer. Rinse until water is clear. Control, collect, and legally dispose of runoff.
- F. Penetrating Stain: Apply penetrating stain to concrete surfaces according to manufacturer's written instructions and as follows:
1. Apply first coat of stain to dry, clean surfaces by airless sprayer or by high-volume, low-pressure sprayer.
 2. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
 3. Rinse until water is clear. Control, collect, and legally dispose of runoff.

END OF SECTION

SECTION 033900 – CONCRETE CURING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Initial and final curing of horizontal and vertical concrete surfaces, excluding site work concrete.

1.2 REFERENCES

- A. ACI 318-14 - Building Code Requirements for Structural Concrete.
- B. ACI 301 - Structural Concrete for Buildings.
- C. ASTM C171 - Sheet Materials for Curing Concrete.

1.3 QUALITY ASSURANCE

- A. Proper curing of concrete shall be the Contractor's responsibility. Improperly cured concrete in the opinion of the Architect shall be removed and replaced at no extra cost to the Owner.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle sheet film materials to avoid puncturing or damage of any kind.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. It shall be the Contractor's Responsibility to provide Curing Materials and Methods in conformance with the Concrete Mix Designer's Recommendations.
- B. Water: Potable and not detrimental to concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify substrate conditions.
- B. Verify that substrate surfaces are ready to be cured.

3.2 EXECUTION - HORIZONTAL SURFACES

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures and mechanical injury.

- B. Maintain concrete with minimal moisture loss at above 50 degrees F temperature for period necessary for hydration of cement and hardening of concrete. Maintain concrete temperature below 95 degrees F. Dusting with dry cement to absorb excess water is prohibited.
- C. Vertical Surfaces: fog spray water over surfaces and maintain wet for 10 days.
- D. Quality Control: Proper curing of concrete surfaces shall be the responsibility of the Contractor under this section.
- E. Flooding, sprinkling or ponding not permitted.

3.3 EXECUTION - VERTICAL SURFACES

- A. Spraying: Spray water over surfaces and maintain wet for 10 days.

3.4 PROTECTION OF FINISHED WORK

- A. Protect finished Work from damage caused by the work of other sections.
- B. Do not permit traffic over unprotected floor surface.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Structural steel.
- 2. Grout.

- B. Related Requirements:

- 1. Section 133419 "Metal Building Systems" for structural steel.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- D. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

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

1.5 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

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

1. Structural-steel materials
2. High-strength, bolt-nut-washer assemblies
3. Threaded rods
4. Forged-steel hardware
5. Shop primer
6. Galvanized-steel primer
7. Etching cleaner
8. Galvanized repair paint

- B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members and connections of the Seismic-Load-Resisting System.
6. Indicate locations and dimensions of protected zones.
7. Identify demand critical welds.

- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

1.7 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

- C. Mill test reports for structural steel, including chemical and physical properties.

- D. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.

4. Shear stud connectors.
 5. Shop primers.
 6. Nonshrink grout.
- E. Survey of existing conditions.
- F. Source quality-control reports.
- G. Field quality-control and special inspection reports.
- 1.8 QUALITY ASSURANCE
- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- B. Comply with applicable provisions of the following specifications and documents:
1. AISC 303.
 2. AISC 341 and AISC 341s1.
 3. AISC 360.
 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
 - 1. Finish: Hot dipped galvanized
- B. Channels, Angles-Shapes: ASTM A 36/A 36M.
 - 1. Finish: Hot dipped galvanized
- C. Plate and Bar: ASTM A 36/A 36M, unless indicated otherwise.
 - 1. Finish: Hot dipped galvanized
- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade C, structural tubing.
 - 1. Finish: Hot dipped galvanized
- E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
 - 1. Weight Class: as indicated.
 - 2. Finish: Hot dipped galvanized
- F. Steel Castings: ASTM A 216/A 216M, Grade WCB, with supplementary requirement S11
 - 1. Finish: Hot dipped galvanized
- G. Steel Forgings: ASTM A 668/A 668M.
 - 1. Finish: Hot dipped galvanized
- H. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.
- B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
 - 1. Finish: Plain.
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

D. Unheaded Anchor Rods: ASTM F 1554, Grade 36, unless indicated otherwise.

1. Configuration: Straight.
2. Nuts: ASTM A 563hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436, Type 1, hardened carbon steel.
5. Finish: Plain.

E. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563hex carbon steel.
2. Washers: ASTM F 436, Type 1, hardened carbon steel.
3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M.

2.3 FORGED-STEEL STRUCTURAL HARDWARE

- A. Clevises and turnbuckles: Made from cold-finished carbon-steel bars, ASTM A 108, AISI C1035.
- B. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, AISI C1030
- C. Sleeve Nuts: Made from cold-finished carbon-steel bars, ASTM A 108, AISI C1018

2.4 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.5 GROUT

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

2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
 1. Camber structural-steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Mark and match-mark materials for field assembly.
 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning." or SSPC-SP 2, "Hand Tool Cleaning." or SSPC-SP 3, "Power Tool Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 1. Joint Type: Pretensioned.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A 123/A 123M.
 1. Fill vent and drain holes that are exposed in the finished work unless they function as weep holes, by plugging with zinc solder and filling off smooth.

2.9 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Surfaces enclosed in interior construction.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
5. SSPC-SP 14/NACE No. 8, "Industrial Blast Cleaning."
6. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
7. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
8. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."
9. SSPC-SP 8, "Pickling."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.

3. Ultrasonic Inspection: ASTM E 164.
 4. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates: Clean concrete bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Weld plate washers to top of baseplate.

3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Pretensioned.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
 - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

END OF SECTION 051200

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Interior non-load-bearing wall framing.
4. Roof rafter framing.
5. Ceiling joist framing.
6. Soffit framing.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Interior non-load-bearing wall framing.
5. Vertical deflection clips.
6. Single deflection track.
7. Drift clips.
8. Roof-rafter framing.
9. Ceiling joist framing.
10. Soffit framing.
11. Post-installed anchors.
12. Power-actuated anchors.
13. Sill sealer gasket.
14. Sill sealer gasket/termite barrier.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: For each type of code-compliance certification for studs and tracks.
- D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency .
 1. Steel sheet.
 2. Expansion anchors.
 3. Power-actuated anchors.
 4. Mechanical fasteners.
 5. Vertical deflection clips.
 6. Horizontal drift deflection clips
 7. Miscellaneous structural clips and accessories.
- E. Research Reports:
 1. For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
 2. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or the Steel Stud Manufacturers Association.
- D. 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."
- E. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. AllSteel & Gypsum Products, Inc.
2. CEMCO; California Expanded Metal Products Co.
3. ClarkDietrich.
4. Consolidated Fabricators Corp.; Building Products Division.
5. Craco Manufacturing, Inc.
6. Custom Stud.
7. Design Shapes in Steel.
8. Formetal Co. Inc. (The).
9. Jaimes Industries.
10. MarinoWARE.
11. MBA Building Supplies.
12. MRI Steel Framing, LLC.
13. Nuconsteel, A Nucor Company.
14. Olmar Supply, Inc.
15. SCAFCO Steel Stud Company.
16. Southeastern Stud & Components, Inc.
17. State Building Products, Inc.
18. Steel Construction Systems.
19. Steel Structural Systems.
20. Steeler, Inc.
21. Super Stud Building Products Inc.
22. Telling Industries.
23. The Steel Network, Inc.
24. United Metal Products, Inc.
25. United Steel Deck, Inc.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
1. Grade: ST33H .
 2. Coating: G60 , A60 , AZ50 , or GF30 .
- B. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: 33 .
 2. Coating: G60 .

2.3 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0677 inch .
 - 2. Flange Width: 2 inches .
 - 3. Section Properties: As Indicated on Drawings .
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch .
 - 2. Flange Width: 1-1/4 inches .
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0677 inch .
 - 2. Flange Width: 2 inches .
 - 3. Section Properties: As Indicated on Drawings .

2.4 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As Indicated .
 - 2. Flange Width: 1-5/8 inches .
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As Indicated, minimum matching steel stud thickness .
 - 2. Flange Width: 1-1/4 inches .
- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: As Indicated .
 - 2. Flange Width: 1 inch plus the design gap for one-story structures .
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 ROOF-RAFTER FRAMING

- A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As Indicated on Drawings .
 - 2. Flange Width: As Indicated on Drawings , minimum.
 - 3. Section Properties: As Indicated on Drawings .

2.6 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As Indicated .
 - 2. Flange Width: 1-5/8 inches , minimum.

2.7 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: As Indicated .
 - 2. Flange Width: 1-5/8 inches , minimum.

2.8 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.
 - 9. Joist hangers and end closures.
 - 10. Hole-reinforcing plates.
 - 11. Backer plates.

2.9 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
- B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC193 ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.
 - 1. Uses: Securing cold-formed steel framing to structure.
 - 2. Type: Torque-controlled expansion anchor or adhesive anchor.
 - 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
 - 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.
- D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.10 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780/A780M MIL-P-21035B or SSPC-Paint 20.
- B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.11 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing 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. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.
- E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF LOAD-BEARING WALL FRAMING

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: As Indicated on Drawings .
- B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track.
 - 1. Fasten both flanges of studs to top and bottom tracks.
 - 2. Space studs as follows:
 - a. Stud Spacing: As indicated on Drawings .
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
 - 2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced vertically 48 inches . Fasten at each stud intersection.
 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
 - J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
 - K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF INTERIOR NONLOADBEARING WALL FRAMING

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 1. Stud Spacing: As indicated on Drawings .
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 3. Connect vertical deflection clips to studs and anchor to building structure.
 4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
1. Install solid blocking at 96-inch centers .
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION OF JOIST FRAMING

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.
- C. Space joists not more than 2 inches from abutting walls, and as follows:
1. Joist Spacing: As indicated on Drawings .
- D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.
1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at smaller intervals of those indicated on drawings or on Shop Drawings. Fasten bridging at each joist intersection as follows:
1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
 2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 INSTALLATION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.8 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Shop fabricated miscellaneous ferrous metal items, galvanized and prime painted, not included in Section 05 12 00, Structural Steel. Items include, but are not limited to, brackets, lintels, ladders, architectural features and similar items as indicated.
- B. Stainless steel metal items such as fascias, shade louvers, countertops and railings, not included in Section 05 12 00, Structural Steel.
- C. Related Sections:
 - 1. Section 05 12 00, Structural Steel Framing

1.2 REFERENCES

- A. American Society of Mechanical Engineers (ASME)
 - 1. ASME B18 Fasteners
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM A36/A36M Carbon Structural Steel
 - 2. ASTM A48/A48M Gray Iron Castings
 - 3. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless
 - 4. ASTM A123 Zinc (Hot-Dip Galvanized) on Coatings on Iron and Steel Products
 - 5. ASTM A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 6. ASTM A276 Stainless Steel Bars and Shapes
 - 7. ASTM A283/A 283M Low and Intermediate Tensile Strength Carbon Steel Plates
 - 8. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
 - 9. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes
 - 10. ASTM A513 - Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
 - 11. ASTM A563 - Carbon and Alloy Steel Nuts
 - 12. ASTM A653/A 653M Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 13. ASTM A666 Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar (non magnetic).
 - 14. ASTM D520 - Standard Specification for Zinc Dust Pigment.
 - 15. ASTM A780 - Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - 16. ASTM C1107 - Packaged Dry Hydraulic - Cement Grout (Non-Shrink)
 - 17. ASTM F594 Stainless Steel Nuts
 - 18. ASTM F1554 - Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
- C. American Welding Society (AWS)
 - 1. AWS A2.4 - Standard Symbols for Welding, Brazing and Non Destructive Examination
 - 2. AWS A5.1 - Carbon Steel Covered Arc-Welding Electrodes

- D. California Code of Regulations (CCR)
 - 1. Title 8, Chapter 3.2
 - 2. Title 8, Division 1, Subchapter 7, Group 1, Article 4, Section 3277, Fixed Ladders
 - 3. Cal/OSHA, Subchapter 4 Construction Safety Orders
 - 4. Title 24, Part 2, 2010 California Building Code (CBC), Chapter 22A.
 - 5. Title 12, California Fire Code Chapter 26 Welding and Other Hot Work.
- E. Steel Structures Painting Council (SSPC)
 - 1. SSPC SP-2 - Steel Preparation

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the 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. Structural steel primer paint.
 - 3. Shrinkage-resistant grout.
- C. Shop Drawings, including complete details and schedules for fabrication and assembly of structural steel members, procedures, and diagrams.
 - 1. Fabricator and detailer shall be responsible for coordination of all contract documents for required steel work. Comply with AISC – Code of Standard Practice for Steel buildings and Bridges, Section 4.
 - 2. Indicate welds by standard AWS symbols, Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories distinguishing between shop and field welds, and show size, length, and type of each weld. Include erection drawings, elevations and details where applicable. Indicate welded connections using standard AWS A2.4 Welding Symbols. Indicate net weld lengths.
 - 3. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.
 - 4. Where drawings are in conflict, detailing shall not be completed for affected items until the detailer has requested clarification/revision from the Architect and has received written directive for such change as may be required. Request for clarification/revision shall be by RFI or by clouded comment on the initial shop drawing submittal. Fabricator shall be responsible for changes to the shop drawings required where shop drawings have progressed prior to resolution of discrepancies.
 - 5. Detailing shall allow for minor coordination changes and revisions as a part of the contract services.
- D. Welder Certifications (in accordance with AWS qualification requirements):

- E. Manufacturer's Certificates certifying welders employed on the work have been AWS qualified within the previous 12 months, in accordance with AWS-WHB-1.
- F. Written Welding Procedure Specification (WPS)
- G. Inspection reports conducted on shop and field High-Strength 'Slip Critical' bolted and welded connections: Include data on type(s) of tests conducted and test results.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following
 1. AWS D1.1, Structural Welding Code--Steel.
 2. AWS D1.3, Structural Welding Code--Sheet Steel.
 3. AWS Certified welders.
 4. AWS D1.6, Structural Welding Code--Stainless Steel.
- B. Coating applicator - Galvanized Metal Fabrications: Company specializing in hot-dip galvanizing after fabrication and following the procedures in the *Quality Assurance Manual* of the American Galvanizers Association.

1.5 FIELD MEASUREMENTS

- A. Verify field measurements prior to submittal of shop drawings and fabrication.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

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

2.2 FERROUS METALS

- A. Steel Sections: ASTM A992 for W-Shape sections and ASTM A36 for all other members.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Bending or cold-formed steel ASTM A283, Grade C.
- D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars ASTM A240, Type 304, Type 304L, Commercial Grade No. 4 finish, 16 gauge minimum, unless otherwise indicated. Stretcher-leveled standard of flatness for countertops.
- E. Stainless-Steel Bars and Shapes ASTM A276, Type 304L.
- F. Steel Round Structural Tubing ASTM A500, Grade B.

- G. Pipe ASTM A53, Grade B, Type E or S, Schedule 40, galvanized where indicated.
- H. Cast Iron ASTM A48/A48M, Class 30, unless another class is indicated or required by structural loads.
- I. Square and rectangular steel tubing structural, carbon steel conforming to ASTM A500.
- J. Mechanical Tubing: ASTM A 513 hot- or cold-rolled carbon steel for non-structural tubing, electric welded tubing.

2.3 FASTENERS

- A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. 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 ANSI B18.2.1; and, where indicated, flat washers and ASTM A325 as indicated on drawings.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts and, where indicated, flat washers; ASTM F593/(ASTM F738M) for bolts and ASTM F594/F836M) for nuts, Alloy Group (A1) (A4).
 - 1. Stainless Steel Fastenings and Fittings at Food Preparation areas
 - a. Bolts and screws with countersunk flat heads at interior and exterior visible or accessible surfaces.
 - b. Use concealed fastenings where possible.
- D. Anchor Bolts ASTM F1554, Grade 36.
- E. Machine Screws ASME B18.6.3.
- F. Lag Bolts ASME B18.2.1.
- G. Wood Screws Flat head, carbon steel, ASME B18.6.1.
- H. Plain Washers Round, carbon steel, ASME B18.22.1.
- I. Lock Washers Helical, spring type, carbon steel, ASME B18.21.1.
- J. Threaded rods, steel yokes and plates – ASTM A36.
- K. Self-drilling, self-tapping screws, ASTM C954, galvanized, minimum #10 unless noted otherwise on drawings. By Buildex/Tomarco or equal.
- L. Anchorage Devices, Drilled Expansion Anchors Minimum 5/8-inch diameter with 3 inch embedment unless noted otherwise on drawings. Allowable shear and tension values as permitted in ICC-ES, ESR-1917 Hilti Kwik Bolt TZ Concrete Anchor or Hilti Kwik Bolt 3, ESR-1385 for masonry anchors, by Hilti Inc., Tulsa, OK.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primer Fabricator's rust inhibitive primer suitable for finish scheduled in Section 09 91 00.
- B. Galvanizing Repair Compound for metal to be painted: ASTM D520 Type III, "ultra pure" high purity grade. Touch-Up products for Galvanized Surfaces Ready mixed Zinc rich galvanizing compound, 95% zinc.
 - 1. Finish: ZRC Products Company, Marshfield, MA or equal. Primer for repaired galvanized to receive a painting finish.
- C. Zinc-Based Solders/Alloys for exposed galvanized finish: Solder Zinc Alloy for Repair ASTM A780 Annex A1; Welco Gal-Viz self-fluxing solder alloy, Galvalloy, Galvabar or equal, ASTM A780, paragraph A1. Repair Using Zinc-Based Alloys.
- D. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. Welding Materials: AWS A5.1, E70XX for Grade 40, E90XX for Grade 60, type and procedures required by electrode manufacturer for materials being welded.
- E. Grout ASTM C1107, Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 8,000 psi at 7 days; of consistency suitable for application and a 30 minute working time.

2.5 FABRICATION

- A. Fit and shop assemble in largest practical sections for delivery to site.
- B. Ease exposed edges to small uniform radius.
- C. Fabricate items with joints tightly fitted and secured.
- D. Welded Joints. Seal joined members by continuous welds. Dress welded joints, leaving no burrs, or sharp or abrasive corners, edges or surfaces.
 - 1. Where exposed to view in finished, interior and exterior habitable spaces, dress welds in accordance with NOMMA Guidelines for Finish 1.
 - 2. Where exposed to view in utility type spaces and roof tops, dress welds in accordance with NOMMA Guidelines for Finish 2.
 - 3. Where concealed, dress welds in accordance with NOMMA Guidelines for Finish 3.
- E. Exposed Mechanically Fastened Joints. Make exposed, mechanically fastened joints hairline-tight, flush, butt joints. Secure with flush-mount, countersunk, screws or bolts; unobtrusively located; consistent with design of component, except where specifically indicated otherwise.
- F. Provide components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as related metal fabrication, unless expressly indicated otherwise.
- G. Stainless Steel Countertops
 - 1. Fabricate from 0.060-inch, minimum, Type 304 stainless steel sheet
 - 2. Exposed surfaces and edges shall have No. 4 (satin) finish.

3. To the extent practicable, fabricate tops in a single piece for each run of casework. Do not locate needed joints within 30-inches of a sink.
 - a. Factory joints: electrically welded, ground smooth and finished to match exposed top surface.
 - b. Field joints: not permitted within openings and serving areas.
 - c. Fabricate field joints to be mechanically cinched with continuous splines and draw bolts resulting in flat level surfaces and a hairline-tight seam, supported the full length of joint.
4. Fabricate tops to be installed without field cutting or drilling. Take measurements at the Site and coordinate fabrication with related casework.
5. Back and end splashes shall be 4-inches high, unless expressly indicated otherwise, and shall meet horizontal surface of top with integral, coved joint. Form tops and backsplashes from single sheet of metal.
6. Reinforce tops with continuous stainless steel channels welded to the underside along length to prevent twisting, oil canning, or buckling of surface. Reinforce tops at the perimeter of sinks.

2.6 FINISHES

A. Steel and Iron

1. Clean surfaces of rust, scale, grease and foreign matter prior to finishing. Prepare in accordance with SSPC SP-2. Dress all welds.
2. Galvanize steel items indicated to zinc coating thickness in accordance with ASTM A123, minimum Coating Grade 80 (1.9 oz/sq. ft.). Surfaces shall be free of icicles, spangles and puddling. Provide venting holes at all enclosed sections, "V" notch, and drilled holes are acceptable. Locate to prevent rainwater from entering enclosed sections at exterior galvanized items. For sheet steel items, galvanize per ASTM A653 G60 Coating Designation.
3. Galvanized items to be painted: Do not use quenching solutions or treatments immediately after galvanizing. Refer to individual sections for galvanized items to be painted and to Section 09 91 00.
4. Do not prime surfaces in direct contact with concrete or where field welding is required.
5. For painted surfaces, prime items with two coats in accordance with requirements of primer specified herein and as required to prevent steel items exposed to elements from rusting prior to application of finishes.

B. Stainless Steel Finishes

1. Remove tool and die marks and stretch lines or blend into finish.
2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of individual pieces, except adjacent lapped or abutted pieces that form a larger panel shall have the grain running in the same direction as directed by Architect.
3. Bright, Directional Satin Finish No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated on shop drawings.
 - 1. Weld joints using shielded metallic electric arc (SMAW) method. Use coated welded rods, not fluxed, or type recommended by manufacturer for use with parent metal. Use only certified welders for structural construction.
 - 2. Grinding: Grind welds on surfaces subject to traffic or contact to smooth flush joints (prior to galvanizing or priming).
 - 3. Peening: Remove flux and weld spatter as necessary to eliminate unsightly conditions and grind off sharp projections.
 - 4. Permanently Concealed Welds: No treatment required other than preparation for painting or galvanizing.
- D. Perform field welding in accordance with AWS standards and procedures for metal alloy welded.
- E. Obtain Architect approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions and surfaces not shop primed or that are damaged during erection, except surfaces to be in contact with concrete.
- G. Repair of Galvanized Surfaces to be Painted: Ready mixed, zinc-rich galvanizing compound, ASTM D520, ASTM A780 - A2. Repair Using Paints Containing Zinc Dust, minimum thickness 5 mils.
- H. Repair of Galvanized Surfaces to be Exposed: ASTM A782 Annex A1, apply Gal-Viz while metal is still hot. Tin surface with Gal-Viz with wire brush. Do not direct flame on alloy. Minimum thickness, 5 mils.

3.4 ERECTION TOLERANCE

- A. Maximum Variation From Plumb: 3/16 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 3/16 inch, non-cumulative.

3.5 FINISHES

- A. Paint with Gloss Polyurethane High Performance Coatings in Special Coatings per Section 09 91 00 Painting.

3.6 SCHEDULE

- A. Schedule is a list of principal items only. Refer to Drawing details and other specification sections for items not specifically scheduled including various miscellaneous steel angles pipes, threaded rods, tubes and similar shapers used for brackets, clips and supports for various items located throughout.
- B. Fasteners: Provide sufficient fasteners and connectors of approved types, whether indicated or not for solid secure attachment and installed in straight lines of uniform pattern. Match finish of steel unless otherwise indicated.
- C. Interior Vertical Access Ladder: as detailed in drawings for field painting.
- D. Steel Backing Plates 1/4 inch thick x widths and lengths required to support wall bumper, plumbing fixture hanger, equipment and as detailed. Cope wood studs and screw plates flush to surface with No. 14 x 2 1/2" wood screws at top and bottom of each stud (16" o.c. max.).
- E. Railing and Handrails as detailed:
 - 1. Galvanized Finish steel pipe and brackets at exterior stairs, ramps and landings where indicated in drawings.
 - 2. Steel pipe guardrails primed for field painting at interior stairs, ramps and landings where indicated in drawings.
- F. Stainless Steel fabrications: 16 gauge Countertops from formed sheet metal and 16 gauge stainless steel wall armor and corner guards. Profiles, shapes, and sizes as indicated in drawings.
- G. Steel brackets and supports for counter tops as detailed.
- H. Steel framing and support for plumbing, mechanical and/or electrical equipment.

END OF SECTION 055000

SECTION 061900 - MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Framing with dimension lumber (also see Section 06 10 00).
 2. Rooftop equipment bases and support curbs.
 3. Wood blocking, cants, and nailers.
 4. Wood furring and grounds.
 5. Wood sleepers.
 6. Installation of Interior wood trim and plywood paneling not specified elsewhere.
 7. Plywood backing panels.
 8. Installation of Finish Door Hardware furnished by others.
 9. Wood backing for wall & ceiling mounted fixtures & equipment.
 10. Finish plywood paneling.
- B. Related Sections include the following:
1. Division 06 Section 06 10 00 "Rough Carpentry" for structural framing material and procedures which take precedence over requirements of section 06 19 00 in case of conflict.
 2. Division 06 Section 16 40 00 "Interior Architectural Woodwork" for Interior Woodwork and cabinetry.

1.2 REFERENCES

- A. FSC – Forest Stewardship Council Principles and Criteria.
- B. ANSI/ASME B18.6.1

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NHLA: National Hardwood Lumber Association.
 3. NLGA: National Lumber Grades Authority.
 4. WCLIB: West Coast Lumber Inspection Bureau.
 5. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. Preservative-treated and Fire-retardant treated wood.
 2. Power-driven fasteners.
 3. Powder-actuated fasteners.
 4. Expansion anchors.
 6. Metal framing anchors.

1.5 QUALITY ASSURANCE

- A. Erector Qualifications: All work to be organized and directed by an experienced, competent carpentry supervisor; and performed by skilled workers experienced with similar work for public school projects.
- B. Requirements of Regulatory Agencies, Codes: Conform to 2013 CBC, Part 2. Chapter 23, and 2005 ANSI/AF & PA NDS.
- C. Allowable Tolerances; Framing Alignment: 3/16" maximum permissible variation from true plane measured from 10' straight edge; 1/8" maximum variation between any two adjacent framing members.
- D. Source Quality Control; Grade Marks: Identify all lumber and plywood by official grade mark of an approved agency.
- E. Standards
1. Grading: In accordance with Section 06 10 00.
 2. Preservative Treatment
 - a. CBC, 2303 1.8 based on various Standard Specifications of American Wood Preservers Bureau (AWPB); Quality Mark by Association approved Agency. AWWA, Standard U1 and M4. Preservative shall be listed in Section 4 of AWWA U1.
- F. All Plywood shall be free of urea-formaldehyde binders and adhesives.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.
- C. Certified wood shall be kept separate from non-certified wood. Auditing process as mandated by certifiers shall be complied with.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWWA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWWA C31 with inorganic boron (SBX).
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete within 8" of exposed soil or exposed to weather.

2.3 DIMENSION LUMBER FRAMING

- A. Maximum Moisture Content: 19 percent.
- B. Non-Load-Bearing Interior Partitions: No. 2 grade or better of any species.
- C. Other Framing: No. 2 grade and any of the following species:
 - 1. Douglas fir-larch; WCLIB or WWPA.
 - 2. Spruce-pine-fir; NLGA.
 - 3. Hem-fir; WCLIB or WWPA.

2.4 MISCELLANEOUS LUMBER

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

- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species, at time of installation unless indicated otherwise.
- C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 INTERIOR WOOD TRIM AND PLYWOOD PANELING

- A. General: Provide kiln-dried finished (surfaced) material without finger-jointing, unless otherwise indicated.
- B. Lumber Trim for Opaque (Painted) Finish: Either finger-jointed or solid lumber, of one of the following species and grades:
 - 1. Grade Finish eastern white pine; NeLMA or NLGA.
- C. Plywood Paneling: 5/8" ACX Birch Veneered or as indicated on drawings.

2.6 CONCEALED, PERFORMANCE-RATED STRUCTURAL-USE PANELS

- A. General: Where structural-use panels are indicated for the "following concealed types of applications," provide APA-performance-rated panels complying with requirements of specification Section 06 10 00 and as designated under each application for grade, span rating, exposure durability classification, and edge detail (where applicable).
 - 1. Thickness: Provide panels meeting requirements specified but not less than thickness indicated.
 - 2. Span Ratings: Provide panels with span ratings required to meet "Code Plus" provisions of APA Form No. E30,"APA Design/Construction Guide: Residential & Commercial."

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements of specification section 06 10 00 and as specified in this Article for material and manufacture.
 - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
 - 2. Fasteners shall be installed with proper means and methods, in properly sized holes and locations as detailed.
 - 3. Nails for attachment of plywood or OSB wall sheathing to sill plates on concrete slabs and footings at or within 8" of exposed soil shall be hot-dipped zinc coating per ASTM A153.
- B. Nails, Brads, and Staples: ASTM F 1667.
 - 1. All nails shall be Common Wire Nails unless otherwise specified. Box, casing or other nails shall not be used unless specifically referenced.
 - 2. Nails, Spikes and Staples: Section 2304.9 CBC, Galvanized for exterior exposed applications, high humidity locations and installation into treated wood; plain finish for other interior and protected locations; size and type to suit application and as specified. Comply with Table 2304.9.1 unless detailed otherwise. Use common nails only.

- C. Powder-Driven Fasteners: ICC ESR-2269.
 - 1. HILTI X-U drive pins of lengths indicated for application required. Designated lengths shall be verified with the supplier for proper application prior to installations.

- D. Wood Screws: ASME B18.6.1.
 - 1. Connecting wood to wood: Wood screws shall be pre-drilled. The lead hole receiving the shank shall be no more than 7/8 of the shank diameter. The lead hold receiving the threaded portion shall no more than 7/8 the diameter of the shank at the threaded portion. Wood screws shall not have upset threads. Decking screws are not allowed. Soap or other lubricant may be used on wood screws to facilitate insertion.
 - 2. Connecting plywood to light gauge steel: Self-drilling, flat Phillips head, zinc-plated steel screws.
 - 3. Connecting plywood to steel shapes: Thread cutting, flat Phillips head, zinc-plated steel screws with blunt points and tap-fluted pilots.

- E. Lag Bolts: ASME B18.2.1. – A 307. See structural drawings for lead hole requirements.

- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and flat washers to all wood surfaces at heads and nuts.

- G. Fasteners: Expansion type or powder actuated type for anchorage to solid masonry or concrete. Refer to Division 01, General Requirements for acceptable types and required testing. Where installation and torque verification of wedge-type anchors is inspected by the IOR, testing of anchors will not be required unless directed by the SEOR for structural tension applications.

- H. Machine-Driven Nailing Approval Procedure:
 - 1. Should Contractor wish to use machine-driven nailing, he shall make specific written request, prior to beginning nailing work, for approval of exact fasteners, equipment, and methods proposed.
 - 2. Request will be reviewed by Architect/Engineer and Division of the State Architect (DSA).
 - 3. Approval, if given, will be in writing, subject to satisfactory field performance.
 - a. Use of machine nailing is subject to a satisfactory job-site demonstration for each Project and approval by Architect or Structural Engineer and DSA. The approval is subject to continued satisfactory performance. Machine nailing will not be approved in 5/16" plywood. If nail heads penetrate the outer ply more than would be normal for a hand hammer or if minimum allowable edge distances are not maintained, the performance will be deemed unsatisfactory.

- I. Metal Framing Anchors:
 - 1. General: provide metal framing anchors of type, size, metal, and finish indicated that comply with requirements specified including the following:
 - a. Standard manufactured, stamped or formed steel, galvanized; types indicated for specific uses; complete with nails.

2.8 MIXES – DRYPACK /GROUT

- A. Mix Proportions: One part Portland cement, 1-1/2 parts sand.
- B. Mixing: With sufficient water to make a stiff mixture, which can be molded, into a sphere.
- C. Strength: Minimum 5,000 psi compressive strength.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Do not splice structural members between supports, unless otherwise indicated.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- E. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities of wood framed construction as indicated and as follows:
 - 1. Fire block concealed spaces of wood-framed walls and partitions at not more than 120 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- thickness.
- F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- G. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. HILTI for powder-driven fasteners, Type X-DN1 for sill plate to concrete.
 - 2. Table 2304.9.1, "Fastening Schedule," in the California Code of Regulations, 2013 California Building Code.

- I. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated. Nail heads may be flush with plywood surface but shall not penetrate the second lamination layers.

3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 ALIGNMENT

- A. On framing members to receive a finished surface, align the finish subsurface to vary not more than 1/8" from the plane of surfaces of adjacent furring and framing members.
- B. Provide solid furring strips of plywood (or hardboard where less than 1/4" thick) over framing member as required to match differing thicknesses of framing members where installing new framing in existing walls and/or to provide flush finished surfaces.

3.4 WOOD TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints.
 1. Match color and grain pattern across joints.
 2. Install trim after gypsum board joint-finishing operations are completed.
 3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads and fill holes.
 4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
- B. Install plywood paneling full length, in the vertical direction.
 1. Fasten with 8d finish nails @ 6" o.c. edges and 12" o.c. in field.
 2. Provide horizontal blocking @ top of panel for nailing of paneling and drywall, and provide full length vertical blocking for all vertical joints of paneling.

3.5 PROTECTION

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

- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

3.6 FINISH HARDWARE INSTALLATION

- A. This section is applicable to the installation of finish hardware where not specifically covered by other specification sections for the doors and/or frames upon which hardware is to be installed.
- B. Site verification of conditions:
 - 1. Prior to the execution of the work under this specification section, inspect the installed work executed under other specification sections of this Project Manual which affect the execution of the work under this specification section.
 - 2. Report unacceptable conditions to the Architect. Do not begin work until unacceptable conditions have been corrected.
 - 3. Execution of work under this specification section shall constitute acceptance of existing conditions.
- C. Coordination:
 - 1. Coordinate the work under this specification section with work specified under other specification sections prior to walls and ceilings being closed in with finish materials to ensure proper and adequate interface of work specified under this specification section.
 - a. Coordinate electrical power needs for those hardware items requiring electrical interface.
 - b. Coordinate electrical alarm needs (security, fire/smoke detection) for those hardware items requiring electrical alarm interface.
 - 2. Obtain all required hardware templates.
- D. Surface preparation:
 - 1. Prepare surface in accordance with manufacturer's instructions and recommendations.
 - 2. Coordinate the blocking required for all wall mounted hardware.
 - 3. Clean substrates of substances (oil, grease, rolling compounds, incompatible primers, loose mill scale, etc.), which could impair bond of materials specified within this section.
- E. Installation:
 - 1. Install in accordance with manufacturer's instructions and recommendations unless specifically noted otherwise.
 - a. Hardware distributor shall assist and advise installer in correcting field problems arising during installation of hardware.
 - b. Hardware distributor shall be on Project within 48 hours upon being notified by the Contractor.
 - c. Hardware distributor shall assist installer in the proper adjustment of all door closers, and other operating devices.
 - 2. Install in accordance with approved shop drawings.
 - 3. Install in accordance with regulatory requirements including latest edition of California Disabilities Act Guidebook (CalDAG).

4. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by the Architect.
 - a. Steel Doors and Frames: "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames: by the Door and Hardware Institute.
 - b. CBC Chapter 11B and Cal DAG, latest version.
 - c. Door opening devices shall be installed at 30" minimum to 44" maximum height.
 5. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where indicated and where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections.
 - a. Do not install surface-mounted items until finishes have been completed on the substrate involved.
 6. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
 7. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
 8. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 7 Section "Sealants and Caulking."
 9. Weather-stripping and seals shall comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.
- F. Field Quality Control Inspection:
1. Contractor shall inspect all hardware to assure that it was installed correctly and is in proper working order.
 2. The Contractor shall schedule an inspection prior to substantial completion, and notify the Owner's Inspector and any regulatory agencies of the time 48 hours prior to the inspection.
 - a. The inspection shall cover checking all locks and verifying that they have been installed in accordance with the hardware schedule and the keying schedule.
- G. Adjusting:
1. Adjust and check each operating item of hardware and each door to ensure proper operations or function of every unit.
 - a. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
 - (1) Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area.
 - (2) Clean operating items as necessary to restore proper function and finish of hardware and doors.
 - (3) Adjust door control devices to compensate for final operations of heating and ventilating equipment.
- H. Cleaning:
1. Clean in accordance with Specification Sections 01 74 00 – Cleaning and 01 77 00 – Project Closeout.
 2. Clean any adjacent soiled surfaces by hardware installation immediately.
 3. Finish shall be clean and ready for the application of any additional finishes.

- I. In accordance with Specification Section 01 77 00 – Project Closeout.
 1. Provide the services of a factory-authorized service representative to demonstrate and train Owner's maintenance personnel as specified below.
 - a. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

END OF SECTION 061900

SECTION 064000 - ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior standing and running trim.
 - 2. Wood and Plastic-laminate cabinets.
 - 3. Plastic-laminate and solid surface countertops.
 - 4. Closet and Utility Shelving.
 - 5. All Cabinet hardware for complete and proper operation.
 - 6. Provide Woodwork Institute certification of all new cabinetry.

- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for metal supports for installing woodwork.
 - 2. Division 06 Section "Miscellaneous Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
 - 3. Division 08 Section "Pre-Finished Wood Doors" for wood doors and wood frames.

- C. Cabinet Locks:
 - 1. Provide locking hardware for cabinetry doors and drawers as indicated by the schedule at the end of the section.

1.2 REFERENCES

- A. California Title 17 Division 3 Subchapter 7.5 Air Bourne Toxic Control Measures, Section 93120.1 through 93120.12.
- B. SCAQMD – South Coast Air Quality Management District Regulations Rule 1168 Adhesive and Sealant Applications.
- C. SJVAPCD – San Joaquin Valley Air Pollution Control District regulations.
- D. FSC – Forest Stewardship Council Principles and Criteria.
- E. Green Seal Standard GS-36, Commercial Adhesives.
- F. CHPS Low-emitting Materials list (http://ww.chps.net/manual/lem_table.htm).
- G. Greenguard Children and Schools (<http://www.greenguard.org/>).

1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated, including hardwood veneers, cabinet hardware and accessories and finishing materials and processes.
- B. Product Data: For high-pressure decorative laminate, adhesive for bonding plastic laminate, cabinet hardware and accessories, and finishing materials and processes.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 2. Show locations and sizes of cutouts and holes for plumbing fixtures faucets and other items installed in architectural woodwork.
 - 3. Apply WI-certified compliance label to first page of Shop Drawings.
- D. Samples for Initial Selection:
 - 1. Shop-applied transparent finishes.
 - 2. Shop-applied opaque finishes.
 - 3. Plastic laminates.
 - 4. PVC edge material.
 - 5. Thermoset decorative panels.
- E. Samples for Verification: (following final color selection):
 - 1. Lumber and panel products with shop-applied opaque finish, min. 12" long x width of material for lumber and 8 by 10 inches for panels, for each finish system and color, with 1/2 of exposed surface finished.
 - 2. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material with specified edge material applied to 1 edge.
 - 3. Thermoset decorative-panels, 8 by 10 inches, for each type, color, pattern, and surface finish.
- F. Product Certificates: For each type of product, signed by product manufacturer.
- G. Woodwork Quality Standard Compliance Certificates: WI-certified compliance certificates.
- H. Qualification Data: For fabricator.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that 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. Shop is a licensee of WI's Certified Compliance Program.
- B. Installer Qualifications: Fabricator of products Licensee of WI's Certified Compliance Program.
- C. Quality Standard: Unless otherwise indicated, comply with WI's "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide WI-certified compliance labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified. Provide shop preliminary inspection prior to delivery and in-place inspection following installation. Contractor shall pay all WI inspection/certification fees including follow-up of deficiencies.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

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 interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Species and Cut for Transparent Finish: Provide AA white maple, plain sliced and of uniform color and grain pattern, or other equivalent species/grade as selected by Architect.
- C. Wood Species for Opaque Finish: Any closed-grain hardwood.
- D. Wood Products: Comply with the following:
 1. Hardboard: AHA A135.4.
 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.

3. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
 4. Softwood Plywood: DOC PS 1.
 5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
- E. Thermoset Decorative Panels: At concealed locations only, it is acceptable to use particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed edges that match color and pattern of interior faces.
- F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard at interior concealed and semi-exposed surfaces only, as indicated in drawings.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:
 - a. Formica Corporation.
 - b. Nevamar Company, LLC; Decorative Products Div.
 - c. Wilsonart International; Div. of Premark International, Inc.
- G. Solid Surface Counters and Facing as indicated in drawings: Cut, formed, built-up and machined to shapes and dimensions indicated in drawings and in accordance with manufacturer's recommendations.
1. Quartz Surfaces: $\frac{3}{4}$ " thickness, color as selected by Architect. Submit full line from 3 manufacturers.
- H. Glass counters, supports, shelving and related accessories, attachments etc. as indicated: Provided by Division 8 Section, Glazing. Coordinate for fit and attachment.

2.2 CABINET HARDWARE AND ACCESSORIES

- A. Provide hardware as indicated on the Drawings and as listed in the Architectural Woodwork Standards, but no less than the following: (all hardware, where exposed to view) must be finished in a Brushed Chrome (Verify prior to ordering)
1. Adjustable shelf standards and supports: Flush mounted
 - a. LD 32mm line boring system 5 mm pins (under 32" wide).
 - b. Knappe and Vogt/No. 255 with No. 256 supports (shelving 32" and wider).
 - c. Provide earthquake pins in back row or notch shelves.
 - d. 32 MM drilled hole system with steel pin shelf supports.
 2. Cabinet Hinges: Minimum 160° opening. Hinge type as selected by Owner & Architect.
 - a. Rockford Process Control (RPC) or approved equal/5 Knuckle Hinges of wrap-around or overlay/specialty configuration to suit conditions for minimal exposure as approved by Owner.
 - b. Frameless concealed hinges (European Type): BHMA A156.9, B01602, self-closing, adjustable.
 3. Cabinet Pulls: Wire type, 3 $\frac{1}{2}$ " center to center, Brushed Chrome (Verify prior to ordering)
 - a. Baldwin Hardware manufacturing Corp./No. 4674
 - b. Stanley hardware/No. 448 3 $\frac{1}{2}$ "
 - c. The Engineered Products Co./No. MX-4023.5

- d. Amerock BP-867
 4. Drawer Slides: Full extension, 100 lb. capacity type with ball bearing steel rollers.
 - a. Grass 6610
 - b. Knappe and Vogt/No. 1429
 - c. Accuride 3832 (3834 at file drawers) – preferred product.
 5. Door and Drawer Locks (with pin tumblers):
 - a. Door and drawer locks shall be National C-8173-915KA-26D and C-8178-915KA-26D respectively.
 6. Elbow Catches for inactive door at pair:
 - a. Bradley Co. No. 2a-92 Ives A10
 7. Cabinet Door Latch System:
 - a. Magnetic Catch: KV-916 (KV-918 on wardrobe doors).
 - b. Friction Catch: 2120 FlexaCatch by Bainbridge.
 - c. Slide Bolt: Surface Bolt by Quality Hardware.
 8. Chain Bolts:
 - a. Stanley 1055 3"
 9. Flipper Door Slide: Install with appropriate bumpers and bearings so as door is not adversely affected by operation nor does the hardware contact the face of the door.
 - a. Grant #513
 - b. Accuride #113 – preferred product
 10. Label holders indicated)
 - a. Brainerd 0736 – B.P.
 11. Lock number tag
 - a. MCS 89602
 12. Wardrobe Hanger Rod
 - a. Hettich oval 2mm x 15mm nickel plated w/009-033 sockets injection molded Plastic Cable Grommet (hole cover) Hafele America Co./No 429-99 series 40mm with outer ring and cover other as available.
 13. Toe Kicks (door mounted) at wheelchair accessible, knee space doors.
 - a. PF Toe Kick (Sunbelt Displays, 1-888-999-7003) with setback to match cabinets for adhesive attachment of rubber topset base to be provided by flooring contractor.
 14. Glass Door Lock:
 - a. KV 965 (opening size under 16 square ft.).
 - b. National C-8140 Pin Tumbler (opening size 16 square ft. or larger).
 15. Sliding Glass Door Track:
 - a. KV 1092 (opening size under 16 square ft.).
 - b. KVP-992 roll easy (opening size 16 square ft. or larger).
 16. Support (Glass Shelves): KV #256-R or LD-KV348.
 17. Sliding Glass Door Pull: KV #831 or Mepla 70.1.
 18. Counter Top Hinge--Soss #204.
- B. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
 1. Product: Subject to compliance with requirements, provide "OG series" by Doug Mockett & Company, Inc.
- C. Exposed Hardware Finishes: Brushed chrome or as otherwise indicated or selected by Architect. Verify prior to ordering.
- D. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
- D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) or other latest adopted regulations:
 - 1. Wood Glues: 30 g/L.
 - 2. Contact Adhesive: 250 g/L.
- E. Adhesive for Bonding Plastic Laminate: Resorcinol, unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive.

2.4 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard except provide Premium grade at hardwood veneer cabinets and at laminated plastic casework with visible/open interiors. Construct all floor supported cabinets with integral base/toe kick.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
 - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- D. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
 - 1. Seal edges of openings in countertops with a coat of varnish and waterproof sealant.

2.5 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. Wood Species and Cut: White Maple, plain sliced, no knots.
- C. For trim items wider than available lumber, use veneered construction. Do not glue for width.
- D. Backcut or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
- E. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.

2.6 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Grade: Custom.
- B. Wood Species: Any closed-grain hardwood.
- C. Backcut or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
- D. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.

2.7 PLASTIC-LAMINATE CABINETS (only where indicated)

- A. Grade: Custom, with upgraded requirements as indicated.
- B. WI Type of Cabinet Construction: Flush overlay.
- C. WI Construction Style: Style A, Frameless.
- D. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.
- E. WI Door and Drawer Front Style: Flush overlay.
- F. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Horizontal Surfaces Other Than Tops: Grade HGS, Nominal 0.048".
 - 2. Post-formed Surfaces: Grade HGP, Nominal 0.039".
 - 3. Vertical Surfaces: Grade HGS, Nominal 0.048".
 - 4. Edges: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish. Door and drawer edges to be 3 mm solid color PVC as selected by Architect.
 - 5. Color, Pattern & Finish: Match adjacent existing cabinetry or be complimentary to it.
- G. Materials for Semi-exposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.

- b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
- 2. Drawer Sides and Backs: Thermoset decorative panels, 1/2" thick.
- 3. Drawer Bottoms: Thermoset decorative panels, 1/2" thick.
- H. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High- pressure decorative laminate, Grade BKL.
- I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As selected by Architect from laminate manufacturer's full range of colors, patterns and finishes.
- J. All open shelving and other cabinets shelving more than 30" wide shall be full 1" thick plastic laminate faced plywood (no particle board or melamine).

2.8 PLASTIC-LAMINATE COUNTERTOPS & SPLASHES (only where indicated)

- A. Types and sizes:
 - 1. Shop fabricate countertops and splashes to the types and dimensions shown on the Drawing. Custom Grade.
 - 2. In wet areas where splashes are called for, provide 4" or higher (as noted) covered splash and square edges unless noted otherwise. Verify all edge types with Architect prior to fabricating. Where required to not interfere with electrical outlet locations, increase height of backsplash up to 10" as directed by Architect at no additional cost to eliminate interference problems.
- B. High-Pressure Decorative Laminate Grade: HGP, Nominal .048".
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated by manufacturer's designations.
 - 2. Match Architect's sample.
 - 3. As selected by Architect from manufacturer's full range of colors, patterns and finishes.
- D. Edge Treatment: Same as laminate cladding on horizontal surfaces.
- E. Core Material: Particleboard made with exterior glue.
- F. Core Material at Sinks: Minimum 5-ply plywood made with exterior glue.
- G. Paper Backing: Provide paper backing (adhered and sealed) on underside of countertop substrate.

2.9 CLOSET AND UTILITY SHELVING

- A. Grade: Custom.
- B. Shelf Material: Full 1-inch thermoset decorative panel with PVC or polyester edge banding on plywood (no particle board).
- C. Cleats: 3/4-inch thermoset decorative panel.

- D. Opaque Finish:
 - 1. Grade: Custom.
 - 2. WI Finish System 2: Water-reducible acrylic lacquer.
 - 3. Color: As selected by Architect from manufacturer's full range.
 - 4. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

2.10 HARDWOOD CABINETS, TOPS & COMPONENTS

- A. Grade: Premium
- B. Provide as indicated in Contract Documents with shop applied transparent finish in accordance with Division 9 Section "Painting".

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

3.2 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor woodwork to concrete, metal strapping or wood blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated. Comply with anchorage details in drawings.
- F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
 - 1. Stagger joints in adjacent and related standing and running trim.
 - 2. Cope at returns and miter at corner to produce tight-fitting joints with full surface contact throughout length of joint.
 - 3. Use scarf joints for end to end joints.
 - 4. Match color and grain pattern across joints.

5. Install trim after gypsum board joint-finishing operations are completed.
 6. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads and fill holes with wood putty matching wood surface, and sand smooth.
 7. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
 8. Install wall railings on indicated metal brackets securely fastened to wall framing.
 9. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
- G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Maintain veneer sequence matching of cabinets with transparent finish.
 3. Fasten wall cabinets through back, near top and bottom, within 3" of cabinet ends and not more than 12 inches o.c. with No. 14 wafer-head screws sized for 1-inch penetration min. 16 GA. Steel strapping or 1-1/2-inch penetration into wood framing, blocking, or hanging strips. Anchors into concrete walls/curbs/floors shall be 3/8" dia. Hilti Kwik Bolt TZ or Simpson Strong-Bolt 2 expansion bolts with 2" embedment.,
- H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Anchor solid surface tops with low voc adhesive.
1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
 3. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."
- I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
- J. Refer to Division 09 Sections for final finishing of installed architectural woodwork not indicated to be shop finished.
- ### 3.3 ADJUSTING AND CLEANING
- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
 - B. Clean, lubricate, and adjust hardware.
 - C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.4 CABINET LOCK SCHEDULE:

- A. Provide locks at doors and drawers as described elsewhere in this section at the following locations (verify specific door/drawers w/Owner):

As indicated on drawings.

END OF SECTION 064000

SECTION 07 05 00 - MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Asphaltic modified bituminous roofing
 - 2. Insulation
- B. Related Sections
 - 1. Section 06100: Rough Carpentry
 - 2. Section 07620: Sheet Metal Flashing and Trim
 - 3. Section 15430: Plumbing Specialties

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM) - *Annual Book of ASTM Standards*
- B. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - *Architectural Sheet Metal Manual*
- C. Asphalt Roofing Manufacturers Association (ARMA)
- D. National Roofing Contractors Association (NRCA)
- E. American Society of Civil Engineers (ASCE)
- F. Factory Mutual (FM Global) - *Approval Guide*
- G. Underwriters Laboratories (UL) - *Roofing Systems and Materials Guide* (TGFU R1306)

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) *Roofing and Waterproofing Manual* for definitions of roofing terms related to this section.

1.4 PERFORMANCE REQUIREMENTS

- A. GAF shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers current application requirements.

1.5 SUBMITTALS

- A. Product Data: Provide product data sheets for each type of product indicated in this section.
- B. Shop Drawings: Provide manufacturers standard details and approved shop drawings for the roof system specified.
- C. Samples: Provide samples of insulation(s), fasteners and roll goods for verification of quality.
- D. Certificates: Installer shall provide written documentation from the manufacturer of their authorization to install the roof system, and eligibility to obtain the warranty specified in this section.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: GAF shall provide a roofing system that meets or exceeds all criteria listed in this section.
- B. Installer's Qualifications:
 - 1. Installer shall be classified as a **GAF Certified™ Commercial Contractor** as defined and certified by GAF.
- C. Source Limitations: All components listed in this section shall be provided by a single manufacturer or approved by the primary roofing manufacturer.

1.7 PRE-INSTALLATION CONFERENCE

- A. Prior to scheduled commencement of the roofing installation and associated work, conduct a meeting at the project site with the installer, architect, owner, GAF representative and any other persons directly involved with the performance of the work. The installer shall record conference discussions to include decisions and agreements reached (or disagreements) and furnish copies of recorded discussions to each attending party. The main purpose of this meeting is to review foreseeable methods and procedures related to roofing work.

1.8 REGULATORY REQUIREMENTS

- A. All work shall be performed in a safe, professional manner, conforming to all federal, state and local codes.
- B. Exterior Fire Test Exposure: Provide a roofing system achieving a UL Class A rating for roof slopes indicated.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver all roofing materials to the site in original containers, with factory seals intact. All products are to carry either a GAF label.
- B. Store all pail goods in their original undamaged containers in a clean, dry location within their specified temperature range.
- C. Store roll goods on end on pallets in a clean, dry, protected area. Take care to prevent damage to roll ends or edges. Do not double stack modified bitumen products.
- D. Do not expose materials to moisture in any form before, during, or after delivery to the site. Reject delivery of materials that show evidence of contact with moisture.
- E. Remove manufacturer supplied plastic covers from materials provided with such. Use "breathable" type covers such as canvas tarpaulins to allow venting and protection from weather and moisture. Cover and protect materials at the end of each workday. Do not remove any protective tarpaulins until immediately before the material is to be installed.
- F. Materials shall be stored above 55°F (12.6°C) a minimum of 24 hours prior to application.

1.10 PROJECT CONDITIONS

- A. Weather
 - 1. Proceed with roofing only when existing and forecasted weather conditions permit.
 - 2. Ambient temperatures must be above 45°F (7.2°C) when applying hot asphalt or water based adhesives.

1.11 WARRANTY

- A. Provide RUBEROID®/GAFGLAS® Diamond Pledge™ ND L Roof Guarantee with edge to edge coverage and no monetary limitation, where the manufacturer agrees to repair or replace components in the roofing system, which cause a leak due to a failure in materials or workmanship.
 - 1. Duration: Twenty (20) years from the date of completion.
 - a. Materials and workmanship of listed products within this section are included when installed in accordance with current GAF application and specification requirements. Contact GAF Technical Support Services for the full terms and conditions of the guarantee.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. Acceptable Manufacturer: GAF, Commercial Roofing Products or equal.

2.2 ANCHOR SHEET

- A. Heavyweight asphalt coated glass fiber base sheet: Conforms to or exceeds requirements of ASTM D 4601, Type II, UL Type G2 BUR, and Federal Spec SS-R-620B Type II. Each roll contains three (3) squares (320 sq. ft.) of material, approximately 39.375" x 97.5' (1 m x 29.7 m); 68 lbs. (30.8 kg), **GAFGLAS® #75** base sheet.

2.3 BASE / PLY SHEETS

- A. Heavyweight asphalt coated glass fiber base sheet: Conforms to or exceeds requirements of ASTM D 4601, Type II, UL Type G2 BUR, and Federal Spec SS-R-620B Type II. Each roll contains three (3) squares (320 sq. ft.) of material, approximately 39.375" x 97.5' (1 m x 29.7 m); 68 lbs. (30.8 kg), **GAFGLAS® #75** base sheet.
- B. Strong, resilient, smooth surfaced asphalt modified bitumen membrane containing a core of non-woven polyester mat coated with flexible, SBS polymer-modified asphalt. Conforms to or exceeds requirements of ASTM D 6164 Type I Grade S. Each roll contains one and one-half squares of material, approximately 39.4" x 49.5' (1 m x 15.09 m), 89.5 lbs. (40.6 kg), **Ruberoid® Mop Smooth 1.5** base/ ply sheet.

2.4 MEMBRANE MATERIALS

- A. Cool Roof Rating Counsel listed, premium, fire resistant, coated granule surfaced modified bitumen sheet containing a core of non-woven polyester mat coated with flexible SBS polymer-modified asphalt. Conforms to or exceeds the requirements of ASTM D 6164 Type II Grade G. Each roll contains one square of material, approximately 39.625" x 32.56' (1 m x 9.92 m), 103.8 lbs. (47.04 kg), **Ruberoid® EnergyCap™ Mop Plus Granule FR** roof membrane.

2.5 FLASHING MATERIALS

- A. Heavyweight asphalt coated glass fiber base sheet: Conforms to or exceeds requirements of ASTM D 4601, Type II, UL Type G2 BUR, and Federal Spec SS-R-620B Type II. Each roll contains three (3) squares (320 sq. ft.) of material, approximately 39.375" x 97.5' (1 m x 29.7 m); 68 lbs. (30.8 kg), **GAFGLAS® #75** base sheet.
- B. Strong, resilient, smooth surfaced asphalt modified bitumen membrane containing a core of non-woven polyester mat coated with flexible, SBS polymer-modified asphalt. Conforms

to or exceeds requirements of ASTM D 6164 Type I Grade S. Each roll contains one and one-half squares of material, approximately 39.4' x 49.5' (1 m x 15.09 m), 89.5 lbs. (40.6 kg), **Ruberoid® Mop Smooth 1.5** base/ ply sheet.

- C. ENERGY STAR listed, premium, fire resistant, coated granule surfaced modified bitumen sheet containing a core of non-woven polyester mat coated with flexible SBS polymer-modified asphalt. Conforms to or exceeds the requirements of ASTM D 6164 Type II Grade G. Each roll contains one square of material, approximately 39.625' x 32.56' (1 m x 9.92 m), 103.8 lbs. (47.04 kg), **Ruberoid® EnergyCap™ Mop Plus Granule FR** roof membrane.

2.6 BITUMEN / ADHESIVES

- A. Asphalt Bitumen: ASTM D 312 Type III or IV
- B. SBS Adhesive: ASTM D 4586, **Matrix™ 102 SBS Membrane Adhesive**, by GAF.
- C. SBS Cement: ASTM D 4586, **Matrix™ 202 SBS Flashing Cement**, by GAF.
- D. Asphalt Primer: ASTM D 41 **Matrix™ 307 Premium Asphalt Primer**, by GAF.

2.7 ACCESSORIES

- A. Nails & Spikes
 - 1. **Cap head nail:** 1" (25 mm) diameter round or square cap, ring shank, or annular threaded. Roofing nail 3/8" (10 mm) diameter head/11-gauge, ring shank, or annular threaded; must be driven through minimum 1" (25 mm) round/square cap plate.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

- A. Obtain verification that the building structure can accommodate the added weight of the new roofing system.
- B. Confirm the adequacy of the new roofing system to provide positive slope to drain. Eliminate ponding areas by the addition of drainage locations or by providing additional pitch to the roof surface.
- C. Prepare substrate surfaces thoroughly prior to application of new roofing materials. This is particularly important for re-cover and reroofing applications. Providing a smooth, even, sound, clean, and dry substrate minimizes the likelihood that underlying deficiencies will cause premature deterioration or even failure of the new roofing system.
- D. All defects in the roof deck or substrate must be corrected by the responsible parties before new roofing work commences. Verify that the deck surface is dry, sound, clean, and smooth, and free of depressions, waves, or projections.
- E. Protect building surfaces against damage and contamination from roofing work.
- F. Where work must continue over completed roof areas, protect the finished roofing system from damage.
- G. Verify that the surfaces and site conditions are ready to receive work.
- H. Verify that the deck is supported and secured.

- I. Verify that the deck surfaces are dry and free of ice or snow.
- J. Verify that all roof openings, curbs, pipes, sleeves, ducts, vents, or other penetrations through the roof are solidly set, and that all flashings are tapered.

3.2 SUBSTRATE PREPARATION

A. General:

- 1. Prepare substrate surfaces thoroughly prior to application of new roofing materials. This is particularly important for re-cover and reroofing applications. Providing a smooth, even, sound, clean, and dry substrate minimizes the likelihood that underlying deficiencies will cause premature deterioration or even failure of the new roofing system.
- 2. The surface of the deck must be dry, firm, smooth, and free of dirt and loose material. Electrical conduits, bolts, and other small items must be removed from the surface of the roof deck; such surface irregularities cannot be properly insulated and roofed. It is the responsibility of the roofing contractor, deck contractor, or owner's representative to determine the suitability of the roof deck surface to receive the roof assembly. The deck must meet GAF requirements as described in the Roof Design section of the current GAF Application and Specifications Manual. None of the foregoing factors are the responsibility of GAF which under no circumstances will assume such responsibility.
- 3. Perimeter and penetration wood nailers and curbs must be in place as specified.
- 4. The roof deck must provide positive drainage or tapered insulation must be used to provide slope.
- 5. Outlets must be placed and installed to remove water promptly and completely from the roof.
- 6. Expansion joints, roof vents, roof drains, etc., must be installed using acceptable industry standards and GAF specifications and flashing details.

B. Tear-off

- 1. All old roofing must be removed down to the deck. The deck shall be cleaned, repaired, and otherwise conditioned to conform to the requirements of a new deck.
- 2. All old flashing must be removed and stripped from walls, curbs, etc.
- 3. All existing composition and metal flashing must be removed and replaced.
- 4. All existing metal counterflashing, metal coping, and other metal work above the roof system must be inspected and replaced or repaired as necessary to provide a watertight assembly.
- 5. All metal flashing must be primed with Matrix™ 307 Premium Asphalt Primer where it will come in contact with the GAF membrane.
- 6. Prime all masonry, metal, and existing asphalt surfaces and substrates with Matrix™ 307 Premium Asphalt Primer where GAF membranes are to be adhered.
- 7. Inspect roof drains and outlets. Remove existing drain flashings and replace broken or stripped bolts, clamping rings, and strainers. Drains must be M-Weld™ drains or drains with metal-type clamping rings. Plastic drains are not acceptable. All drains, including retro fit or insert drains, must be sumped to promptly remove water from the roof surface and meet code requirements.

8. **Note: Substrates must be inspected and accepted by the deck contractor, roof contractor, or owner as being ready to receive and hold the roof system as specified.**

C. Plywood Deck

1. Plywood sheathing must be exterior grade, minimum 4 ply, and not less than 15/32" (12 mm) ***Dade county*** 19/32" (15 mm) thick.
2. Preservatives or fire retardants used to treat the decking must be compatible with roofing materials.
3. The deck must be installed over joists that are spaced 24" (61 cm) o.c. or less.
4. The deck must be installed so that all four sides of each panel bear on and are secured to joist and cross blocking. "H" clips are not acceptable.
5. Panels must be installed with a 1/8" to 1/4" (3mm – 6mm) gap between panels and must match vertically at joints to within (1/8" (3mm).
6. Decking should be kept dry and roofed promptly after installation.
7. Light metal wall ties or other structural metal exposed on top of the wood deck shall be covered with one ply of a heavy roofing sheet, such as Stratavent® Eliminator™ Nailable Base Sheet, extending 2"-6" (5.1 cm – 15.2 cm) beyond the metal in all directions. Nail in place before applying the base ply.
8. Tape and staple fastening systems may be used on wood decks when they comply with local building codes.
9. Attach an acceptable base sheet through flat metal caps or use nails with attached 1" (25 mm) square or round metal caps that have a minimum withdrawal resistance of 40 pounds each (178 N).

D. Oriented Strand Board (OSB) Deck

1. Oriented Strand Board must carry a Structural 1 rating if it is to be used as a decking material.
2. Preservatives or fire retardants used to treat decking must be compatible with roofing materials.
3. The deck must be installed over joists that are spaced 24" (61 cm) o.c. or less.
4. The deck must be installed so that all four sides of each panel bear on and are secured to joist and cross blocking; the APA/Engineered Wood Association (APA) recommendations. "H" clips are not acceptable.
5. Panels must be installed with a 1/8" to 1/4" (3mm – 6mm) gap between panels and must match vertically at joints to within (1/8" (3mm).
6. Decking should be kept dry and roofed promptly after installation.
7. When light metal wall ties or other structural metal are exposed on top of the wood deck, cover them with a heavy ply of a roofing sheet, such as Stratavent® Eliminator™ Nailable Base Sheet, extending 2"-6" (5.1 cm – 15.2 cm) beyond the metal in all directions. Nail in place before applying the base ply.
8. Tape and staple fastening systems may be used on wood decks when they comply with local building codes.
9. Attach an acceptable base sheet through flat metal caps or use nails with attached 1" (25 mm) square or round metal caps that have a minimum withdrawal resistance of 40 pounds each (178 N).

3.3 INSTALLATION

A. General:

1. Install GAF roofing system according to all current application requirements in addition to those listed in this section.
2. Substrates must be inspected and accepted by the contractor as suitable to receive and hold roof membrane materials.
3. Start the installation of all membrane plies at the low point or drains, so the flow of water is over or parallel to the ply laps, but never against the laps.
4. Chalk lines where necessary to ensure proper alignment and headlap widths of membrane plies.
5. Use half base sheet width as a starter strip in two-ply roof constructions.
6. Installation of all membrane plies, except those that are mechanically fastened, shall result in a visible, uniform flow-out of bitumen at side and end laps.
7. Ensure that all membrane plies lay flat and are uniformly secured to their substrate. Wrinkles, fishmouths, and similar defects must be removed and patched.
8. Extend all membrane plies to dimensions necessary to accommodate flashing conditions shown in the RUBEROID®/GAFGLAS® Roof Flashing Details Manual.
9. All lap edges for GAF cap membranes shall be rolled-in or walked-in immediately after installation. Additional care must be taken to ensure complete bonding at “T” laps. Lap edges on all membrane sheets should be inspected for full and uniform bonding to the underlying membrane sheet.
10. Stagger all adjacent end laps for all membrane plies a minimum of 18" (457 mm). Side laps shall not coincide with underlying plies in multiple layer applications.
11. Prime all masonry, metal, and existing asphalt surfaces and substrate with asphalt primer where insulation or GAF membranes are to be adhered. Matrix™ 307 Premium Asphalt Primer (ASTM D41) shall be applied at the rate of 1 gal/square (0.41 L/m²). Allow the primer adequate time to dry.
12. Brooming-in of glass felts is vital to minimize voids and ensure complete, uniform attachment.
13. Occasionally, a roll of felt or membrane will contain a splice that was fabricated as part of the manufacturing process. These splices are marked. Cut out all splices and treat as an end lap.
14. Back nailing of felts and cap sheets, and the use of ASTM D312 Type IV asphalt is required on slopes 1/2:12 or greater. Refer to “Steep- Slope Requirements” in the next section.

B. Phasing:

1. The term “phasing” refers to the practice of applying part of a total roof membrane at one time and allowing that part to remain exposed to the weather for a period of time before applying the remaining elements of the roof system. Membranes applied in this manner are subject to early deterioration.
2. Blisters, voids, membrane damage, and moisture infiltration are much more likely to occur in “phased” roof membranes.
3. GAF does not approve the practice of “phasing”.
4. Whenever it is necessary to put a building “in the dry” quickly, a temporary roof covering is recommended; this temporary roof should be removed prior to installation of the roof system.

3.4 STEEP SLOPE REQUIREMENTS **optional**

A. General:

1. Slippage of roofing systems may occur on slopes of 1/2:12 or greater. Supplemental fastening is therefore required, and, for most systems, all base, ply, and cap sheets must be installed parallel with the slope (strapping method) in accordance with the Steep-Slope Membrane Application Table. If the roof slope is less than 1/2:12, supplemental fastening and membrane strapping is not required.
 2. Use wood nailers (insulation stops) at least 3 1/2" (89 mm) wide and equal in thickness to the insulation. Nailers must be mechanically fastened to the deck and installed at right angles to the direction of the slope.
 3. On ridges where insulation stops are required, wood nailers must be a minimum 3 1/2" (89 mm) wide and equal in thickness to the insulation. Nailers shall be secured mechanically to the deck on both sides of the ridge. Where nailers meet, bevel edges to form a flush surface for membrane application.
- B. Wood Nailers on Slopes of 1/2:12 but less than 2:12:
1. For slopes 1/2:12 but less than 2:12, install wood nailers at the eave, at the ridge, and at intermediate points of no more than 16' (4.9 m) as outlined under the Steep-Slope Membrane Application Table. All dimensions are from inside face to inside face of the wood nailers. Ensure a snug fit with the courses of insulation, but where possible, avoid cutting the insulation.
 2. For non-insulated, nailable decks, back-nail the leading edge of the base plies directly to the deck at intervals not to exceed 16' (4.9 m). All fasteners should be covered by following courses.
 3. For non-insulated, non-nailable decks, set the wood nailers flush with decks and back-nail plies at intervals not to exceed 16' (4.9 m). All fasteners should be covered by following courses.
- C. Wood Nailers on Slopes of 2:12 but less than 3:12:
1. For slopes 2:12 to 3:12, install wood nailers at the eave, at the ridge, and at intermediate spacing of no more than 8' (2.4 m) as outlined under the Steep-Slope Membrane Application Table. All dimensions are from inside face to inside face of the wood nailers.
 2. Ensure a snug fit with the courses of insulation but avoid cutting the insulation where possible.
 3. For non-insulated, nailable decks, back-nail the plies directly to the deck at intervals not to exceed 8' (2.4 m). All fasteners should be covered by following courses.
 4. For non-insulated, non-nailable decks, set the wood nailers flush with decks and install at intervals not to exceed 8' (2.4 m). All fasteners should be covered by following courses.
- D. Wood Nailers on Slopes Greater than 3:12:
1. For roofs with slopes greater than 3:12, contact GAF Technical Support Services at 1-800-766-3411.
- E. Insulation Installation:
1. If insulation is to be installed, place insulation between wood nailers and mechanically attach, set in a GAF insulation adhesive, or set in hot asphalt.
- F. Membrane Installation:

1. Steep-slope applications require installation of all base and ply sheets parallel to slope (Strapping Method) as required in the Steep-Slope Membrane Layout table. Back-nail each course into wood nailers or nailable decks approximately 1" (25 mm) from the leading edge of the sheets at recommended intervals. All end laps must be at wood nailers and blind-nailed into the wood nailer on 8" (203 mm) centers. Use nails with integral metal heads at least 1" (25 mm) round or square. For non-insulated, nailable decks, back-nail the leading edge of each course as described above directly into the deck at recommended intervals.
2. At ridges, base plies must extend across opposite sides of ridge over the nailer and be fastened on 8" (203 mm) centers. Use nails with integral metal heads at least 1" (25 mm) round or square. An additional layer of base sheet shall be centered over the ridge overlapping the fasteners at least 6" (152 mm).
3. After completion and fastening of base plies, install GAFGLAS® cap sheets or RUBEROID® membranes parallel to slope (Strapping Method) as required in the Steep-Slope Membrane Layout table. Terminate GAFGLAS® cap sheets or RUBEROID® membranes at wood nailers and fasten the top edge of each sheet with screws and 3" (76 mm) plates on 8" (203 mm) centers across the top of the sheet. The overlapping sheet must extend at least 9" (229 mm) past the top of the underlying sheet. All end laps must be staggered to the closest wood nailer, spaced a minimum of 4' (1.2 m). On slopes of 2:12 to 3:12, the GAFGLAS® cap sheets or RUBEROID® membranes must be cut into lengths not to exceed 17' (5.2 m). For non-insulated wood decks, terminate and fasten the end of the GAFGLAS® cap sheets or RUBEROID® membranes to the deck with the same fasteners, on the same spacing indicated above.
4. At ridges, cap sheets or RUBEROID® membranes must extend across opposite sides of the ridge over the nailer and be fastened with screws and 3" (76 mm) plates on 8" (203 mm) centers. An additional full-width ply of cap sheet or RUBEROID® membrane must be centered over the ridge to form a ridge cap, overlapping the fasteners at least 6" (152 mm).

3.5 BITUMEN

- A. Do not mix different types of asphalt.
- B. Use only ASTM D 312, Type III or Type IV Steep Asphalt. **Type III asphalt may be used on slopes up to 1/2" per foot (4cm/m). Type IV asphalt must be used on all slopes greater than 1/2" per foot (4 cm/m).**
- C. Application with hot asphalt requires continuous, uniform interply mopping rates of 25 lbs. +/- 20% per 100 square feet of roof area (1.2 kg/m²).
- D. Application temperature of the asphalt must be at the Equiviscous Temperature (EVT) with a tolerance of +/- 25°F (13.9°C), at which a viscosity of 125 centipoise is attained. When using mechanical asphalt applicators, the target viscosity should be 75 centipoise.
- E. For all SBS modified asphalt flashings; the minimum application temperature of the asphalt must be at the EVT or 425°F (218°C), whichever is greater, with a rolling bank (puddle) of mopping asphalt across the full width of the roll.
- F. Do not heat the asphalt to or above its flash point or hold the asphalt at temperatures above the finished blowing temperature for more than 4 hours.
- G. Do not keep heated tankers above 325°F (163°C) overnight.

3.6 BASE SHEET***MECHANICALLY ATTACHED***

- A. Roll the base sheet out over the deck insulation and allow it to relax. Lap the base sheet so the flow of water is over or parallel to, but never against the laps.
- B. Lap the base sheet 2" (5.1 cm), and 4" (10.2 cm) on the ends. Keeping the base sheet taut, push out all wrinkles and buckles ahead as fastening proceeds.
- C. Turn base sheet up to the top of the cant.
- D. Stagger adjacent end laps a minimum of 18" (45.7 cm).
- E. (Option 1)Fasten base sheet per code requirements.
- F. (Option 2 standard pattern-no insulation)Lap the base sheet 2" (51 mm), and mechanically fasten with three rows of fasteners. The first row (on the seam) will be 1" (25 mm) from the leading edge and on 9" (229 mm) centers. Locate the second row of fasteners 14" (356 mm) from the leading edge and on 18" (457 mm) centers. The third row of fasteners shall be 26" (660 mm) from the leading edge on 18" (457 mm) centers. The centers for the second and third rows should be staggered.
- G. (Option 3 standard pattern-sim attach with insulation)Lap the base sheet 2" (51 mm). Screws and plates are then installed in 3 staggered, equally spaced rows on 24" (610 mm) maximum centers in each row. One row is in the 2" (51 mm) side lap, the other rows are located equidistant from the lap rows approximately 12" - 13" (305 - 330 mm) from the lap rows. This pattern results in approximately one fastener per 2.1 square feet (0.20 m²). Along building perimeters (minimum 4 foot wide) (1.22 m) fastening pattern must be increased to one fastener per 1.2 square feet (0.11 m²), in 4 staggered, equally spaced rows of fasteners on 18" (457 mm) centers
- H. Refer to FMRC Approval Guide for FM Fastening patterns. Factory Mutual requires fastener density increases in perimeter and corner zones for FM 1-60 and FM 1-90 or greater. Refer to FM Loss Prevention Data Sheets 1-7, 1-28, 1-29 and 1-49.

Note: When fastening base sheets using screws and plates without insulation, the plate must be of a design that allows it to lie flat on the deck.

3.7 SBS BASE/PLY SHEET

- A. Install full width ply sheets, lapping 3" (7.62 cm) on the sides and 6" (15.2 cm) on ends. All end laps must be staggered a minimum of 18" (45.7 cm) so that no adjacent end laps coincide. If end laps fall in line or are not staggered the proper distance, a full width of Ruberoid® Mop SBS membrane must be installed over the end laps.
- B. For slopes less than 1/2" per foot (4.2 cm per meter), Type III or IV asphalt may be used. Type IV must be used on all slopes 1/2" per foot (4.2 cm per meter) and over. Asphalt shall be applied at its EVT temperature or 425°F (218°C), whichever is greater, in a uniform layer, without voids, at a rate of 25 lb./square (1.2 kg/m²) ±20%. See Article 3.04 "Bitumen". The mopping stroke will be such that the side lap is covered with asphalt last. A rolling bank (puddle) of mopping asphalt must be maintained across the full width of the roll.
- C. All laps must be parallel or perpendicular to the slope of the roof such that the flow of water is never against the lap.

- D. SBS membranes must not be applied during adverse weather or without precautionary measures in temperatures below 45°F (7.2°C). Contact GAF Contractor Services for details.
- E. Coiled rolls should be unrolled, placed upside down and allowed to “relax” prior to installation. Then re-roll to apply.
- F. Care should be taken to insure that the ply sheet lays flat in the asphalt. There must be complete adhesion between the ply sheet and the mopping asphalt. Brooming of the plies may be necessary under certain conditions to insure that the cap sheet adheres solidly to the asphalt. Apply extra pressure to avoid creating open channels, where three or more membranes are lapped.
- G. A minimum 3/8” (10 mm) asphalt flow-out must be obtained at all laps. Dry laps are not acceptable. Check all seams for full and uniform adhesion.

3.8 CAP SHEET***HOT CAP***

- A. Install full width cap sheets, lapping 3” (7.62 cm) on the sides and 6” (15.2 cm) on ends. All side and end laps must be staggered from underlying plies. All end laps must be staggered a minimum of 18” (45.7 cm) so that no adjacent end laps coincide. If end laps fall in line or are not staggered the proper distance, a full width of Ruberoid® Mop SBS membrane must be installed over the end laps.
- B. For slopes less than 1/2” per foot (4.2 cm per meter), Type III or IV asphalt may be used. Type IV must be used on all slopes 1/2” per foot (4.2 cm per meter) and over. Asphalt shall be applied at its EVT temperature or 425°F (218°C), whichever is greater, in a uniform layer, without voids, at a rate of 25 lb./square (1.2 kg/m²) ±20%. See Article 3.04 “Bitumen”. The mopping stroke will be such that the side lap is covered with asphalt last. A rolling bank (puddle) of mopping asphalt must be maintained across the full width of the roll.
- C. All laps must be parallel or perpendicular to the slope of the roof such that the flow of water is never against the lap.
- D. SBS membranes must not be applied during adverse weather or without precautionary measures in temperatures below 45°F (7.2°C). Contact GAF Contractor Services for details.
- E. Coiled rolls should be unrolled, placed upside down and allowed to “relax” prior to installation. Then re-roll to apply.
- F. Care should be taken to ensure that the cap sheet lays flat in the asphalt. There must be complete adhesion between the cap sheet and the mopping asphalt. Brooming of the plies may be necessary under certain conditions to ensure that the cap sheet adheres solidly to the asphalt. Apply extra pressure to avoid creating open channels, where three or more membranes are lapped.
- G. A minimum 3/8” (10 mm) asphalt flow-out must be obtained at all laps. Dry laps are not acceptable. Check all seams for full and uniform adhesion.

****For EnergyCap only****

- H. If damage by other trades or any inadvertent damage should occur to the EnergyCap™ product during installation, and for aesthetic purposes only, an additional fog coat of EnergyCote™ coating can be applied to the sheet at a rate of 1/2 to 1 gallon per 100 sq. ft.

3.9 PLY / CAP SHEET***HOT SBS PLIES & CAP***

- A. Install one ply of the specified Ruberoid® smooth sheet and follow with the specified granule surfaced sheet.
- B. Sheets shall be lapped 3” on the sides and all end laps must be staggered a minimum of 18” (45.7 cm) so that no adjacent end laps coincide. If end laps fall in line or are not staggered the proper distance, a full width of Ruberoid® SBS membrane must be installed over the end laps
- C. For slopes less than 1/2” per foot (4.2 cm per meter), Type III or IV asphalt may be used. Type IV must be used on all slopes 1/2” per foot (4.2 cm per meter) and over. Asphalt shall be applied at its EVT temperature or 425°F (218°C), whichever is greater, in a uniform layer, without voids, at a rate of 25 lb./square (1.2 kg/m²) ±20%. See Article 3.04 “Bitumen”. The mopping stroke will be such that the side lap is covered with asphalt last. A rolling bank (puddle) of mopping asphalt must be maintained across the full width of the roll.
- D. All laps must be parallel or perpendicular to the slope of the roof such that the flow of water is never against the lap.
- E. SBS membranes must not be applied during adverse weather or without precautionary measures in temperatures below 45°F (7.2°C). Contact GAF Contractor Services for details.
- F. Coiled rolls should be unrolled, placed upside down and allowed to “relax” prior to installation. Then re-roll to apply.
- G. Care should be taken to ensure that the cap sheet lays flat in the asphalt. There must be complete adhesion between the cap sheet and the mopping asphalt. Brooming of the plies may be necessary under certain conditions to ensure that the cap sheet adheres solidly to the asphalt. Apply extra pressure to avoid creating open channels, where three or more membranes are lapped.
- H. A minimum 3/8” (10 mm) asphalt flow-out must be obtained at all laps. Dry laps are not acceptable. Check all seams for full and uniform adhesion.
- I. Membranes must not be applied during adverse weather or without precautionary measures in temperatures below 45°F (7.2°C). Contact GAF Contractor Services for details.

****For EnergyCap only****

- J. If damage by other trades or any inadvertent damage should occur to the EnergyCap™ product during installation, and for aesthetic purposes only, an additional fog coat of EnergyCote™ coating can be applied to the sheet at a rate of 1/2 to 1 gallon per 100 sq. ft.

3.10 CAP SHEET***COLD APPLIED CAP SHEET ONLY***

- A. Install full width cap sheet, lapping 2” (5.1 cm) on the sides and 3” (7.62 cm) on the ends. Stagger adjacent end laps a minimum of 18” (45.7 cm) apart. Where installed over base sheet, stagger ply sheet’s side and end laps from underlying plies. If end laps fall in line or are not staggered the proper distance, a full width of Ruberoid® SBS membrane must be installed over the end laps.

- B. For slopes less than 1/2" per foot (4 cm per meter), membrane should be applied shingle fashion, perpendicular to the slope of the roof deck. On all slopes 1/2" per foot (4 cm per meter) and over, membrane should be installed parallel to the slope of the roof. In no case should the flow of water be against the laps.
- C. SBS membranes must not be applied during adverse weather or without precautionary measures in temperatures below 45°F (7.1°C). Contact GAF Contractor Services for details.
- D. The membrane material shall be unrolled, cut into 12'-18' (3.7-5.5 m) lengths, placed upside down and allowed to "relax" prior to installation. Then re-roll to apply.
- E. Starting at the low point or the drains, apply the Matrix™ cold adhesive to the substrate as follows:
 - 1. Pour the adhesive on the substrate and spread, using a serrated edged squeegee, applied at the rate of 1-1/2 gal per square (6 L/m²), or,
 - 2. Spray, using equipment that will apply the adhesive at a rate equal to 1-1/2 gal/square (6 L/m²).
- F. Apply the adhesive so that the substrate is coated in a pattern slightly larger than the first sheet being applied.
- G. End laps and selvage laps of the Ruberoid® being lapped must be coated with adhesive so that a visible bead of adhesive appears. Roll all laps with a steel roller to ensure proper adhesion. Alternately, the end laps and side laps may be hot-air welded. The hot-air welding method will provide a watertight lap immediately and may be preferable when inclement weather is threatening.
- H. Allow 5 to 15 minutes for solvents to evaporate from the adhesive (i.e. tack time or open time) before embedding any sheets into newly applied adhesive. Tack times may vary based on ambient conditions.
- I. Be careful to ensure that the Ruberoid® membrane lays flat in the cold adhesive. There must be complete adhesion between the cap sheet and the cold adhesive. Brooming of the plies may be necessary under certain conditions to assure that the cap sheet adheres solidly to the cold adhesive. Apply extra pressure to avoid creating open channels where three or more membranes are lapped.
- J. A minimum 3/8" (10 mm) and maximum 1" (2.5 cm) cold adhesive flow-out must be obtained at all seam areas when the side laps are not heat welded. Dry laps are not acceptable. Check all seams for full and uniform adhesion.
- K. Precautions:
 - 1. Certain Matrix Adhesives, Flashing Cements and Coatings are solvent based and do have an odor. These products will exhibit solvent odor during application and afterwards until fully cured and set up. Cure times can vary widely according to factors such as type of system installed, local weather and ambient temperatures. Precautions must be taken by the roofing contractor and project designer to minimize solvent odor penetration into occupied building spaces.
 - 2. Air intakes near the roof should be closed. Ductwork, equipment curbs, parapet walls, HVAC equipment and other deck penetrations or openings should be checked for entry sources and addressed to prevent possible odor infiltration.

3. On wood decks, a minimum 6-mil thick polyethylene sheet is required, installed directly on the deck to minimize potential odors entering the building during the roof installation and during the cure time. Air barriers should be considered for all porous deck types, terminated, and sealed to penetrations, walls, curbs, openings, and other roof terminations. (Caution: Polyethylene can be slippery. Until a base sheet can be securely nailed, or insulation can be mechanically attached, care must be taken when walking on the polyethylene to prevent slipping and falling.) Use of an air barrier may create a vapor retarder condition within the assembly and requires consideration of applicable dew point factors and thermal insulation requirements by the project designer.
4. Ruberoid cold process roof systems should not be used in situations where the underside of the roof deck is used as the top of a plenum of a HVAC system. This type of system is susceptible to solvent odor entry migrating through the deck and into the plenum space until the adhesives are fully cured.

3.11 PLY/ CAP SHEET***COLD PLIES & CAP***

- A. Install one ply of the specified Ruberoid® smooth sheet and follow with the specified granule surfaced sheet.
- B. Sheets shall be lapped 3" on the sides and all end laps must be staggered a minimum of 18" (45.7 cm) so that no adjacent end laps coincide. If end laps fall in line or are not staggered the proper distance, a full width of Ruberoid® SBS membrane must be installed over the end laps
- C. For slopes less than 1/2" per foot (4 cm per meter), membrane should be applied shingle fashion, perpendicular to the slope of the roof deck. On all slopes 1/2" per foot (4 cm per meter) and over, membrane should be installed parallel to the slope of the roof. In no case should the flow of water be against the laps.
- D. SBS membranes must not be applied during adverse weather or without precautionary measures in temperatures below 45°F (7.1°C). Contact GAF Contractor Services for details.
- E. The membrane material shall be unrolled, cut into 12'-18' (3.7-5.5 m) lengths, placed upside down and allowed to "relax" prior to installation. Then re-roll to apply.
- F. Starting at the low point or the drains, apply the Matrix™ cold adhesive to the substrate as follows:
 1. Pour the adhesive on the substrate and spread, using a serrated edged squeegee, applied at the rate of 1-1/2 gal per square (6 L/m²), or,
 2. Spray, using equipment that will apply the adhesive at a rate equal to 1-1/2 gal/square (6 L/m²).
- G. Apply the adhesive so that the substrate is coated in a pattern slightly larger than the first sheet being applied.
- H. End laps and selva laps of the Ruberoid® being lapped must be coated with adhesive so that a visible bead of adhesive appears. Roll all laps with a steel roller to ensure proper adhesion. Alternately, the end laps and side laps may be hot-air welded. The hot-air welding method will provide a watertight lap immediately and may be preferable when inclement weather is threatening.

- I. Allow 5 to 15 minutes for solvents to evaporate from the adhesive (i.e. tack time or open time) before embedding any sheets into newly applied adhesive. Tack times may vary based on ambient conditions.
- J. Be careful to ensure that the Ruberoid® membrane lays flat in the cold adhesive. There must be complete adhesion between the cap sheet and the cold adhesive. Brooming of the plies may be necessary under certain conditions to assure that the cap sheet adheres solidly to the cold adhesive. Apply extra pressure to avoid creating open channels where three or more membranes are lapped.
- K. A minimum 3/8" (10 mm) and maximum 1" (2.5 cm) cold adhesive flow-out must be obtained at all seam areas when the side laps are not heat welded. Dry laps are not acceptable. Check all seams for full and uniform adhesion.
- L. Precautions:
 - 1. Certain Matrix Adhesives, Flashing Cements and Coatings are solvent based and do have an odor. These products will exhibit solvent odor during application and afterwards until fully cured and set up. Cure times can vary widely according to factors such as type of system installed, local weather and ambient temperatures. Precautions must be taken by the roofing contractor and project designer to minimize solvent odor penetration into occupied building spaces.
 - 2. Air intakes near the roof should be closed. Ductwork, equipment curbs, parapet walls, HVAC equipment and other deck penetrations or openings should be checked for entry sources and addressed to prevent possible odor infiltration.
 - 3. On wood decks, a minimum 6-mil thick polyethylene sheet is required, installed directly on the deck to minimize potential odors entering the building during the roof installation and during the cure time. Air barriers should be considered for all porous deck types, terminated, and sealed to penetrations, walls, curbs, openings, and other roof terminations. (Caution: Polyethylene can be slippery. Until a base sheet can be securely nailed, or insulation can be mechanically attached, care must be taken when walking on the polyethylene to prevent slipping and falling.) Use of an air barrier may create a vapor retarder condition within the assembly and requires consideration of applicable dew point factors and thermal insulation requirements by the project designer.
 - 4. Ruberoid cold process roof systems should not be used in situations where the underside of the roof deck is used as the top of a plenum of a HVAC system. This type of system is susceptible to solvent odor entry migrating through the deck and into the plenum space until the adhesives are fully cured.

3.12 BITUMINOUS BASE FLASHINGS***Hot Asphalt (Option 1)***

- A. Install GAF base flashing over all cant strips, horizontal to vertical transitions, roof edges and roof penetrations. Flashings are to be secured in accordance with current GAF application guidelines.
- B. Nailable curbs and walls must be covered with a layer of approved GAFGLAS® Base Sheet or backer ply fastened 8" (20.3 cm) o.c. in all directions with approved fasteners. All vertical laps shall be 4" (10.2 cm). Base sheet or backer ply must extend out onto the field of the roof as shown in the applicable GAF construction detail.
- C. Prime all metal and masonry surfaces with asphalt primer and allow adequate drying time prior to adhering flashing plies.
- D. Backer plies installed over masonry or other non-nailable substrates must be cut into manageable lengths to ensure adequate adhesion to the cant strip and vertical surfaces without excessive voids. All vertical laps shall be 4" (10.2 cm). Backer plies shall extend onto the field of the roof as shown in the applicable GAF construction detail.
- E. The finished ply of base flashing shall be run vertically to provide a selvage edge that will aid in achieving proper adhesion at the 3" (7.6 cm) vertical laps. If the sheet is run horizontally, the vertical laps must be a minimum of 6" (15.2 cm) and the selvage edge must be removed from the sheet or fully covered by the counterflashing. The finished flashing ply must extend out onto the field of the roof as shown in the applicable GAF construction detail and must be extended a minimum of 4" (10.2 cm) beyond the edge of the prior flashing plies. The flashing must be soundly adhered to the parapet, cant area and roof surface to result in a minimum void, non-bridging construction.
- F. Base flashing heights must be a minimum of 8" (20.3 cm) and a maximum of 24" (61.0 cm) above the roofline.
- G. Use only Type IV hot asphalt. Maintain asphalt at the Equiviscous Temperature (EVT) $\pm 25^{\circ}\text{F}$ (13.9°C) for all base and ply sheets used in flashing details. Apply flashing membranes at the EVT temperature or 425°F (218°C) whichever is greater. Firmly press sheets into the adhesive, and immediately nail the top of the flashing as specified in the appropriate flashing detail.
- H. Corner membrane flashings, such as "bow ties" for outside corners and "footballs" for inside corners or other membrane reinforcements are required to ensure that base flashing corners are sealed at cant areas. An alternate method of corner reinforcing is to install a smooth MB membrane reinforcement piece on the prepared corner substrate prior to final surfacing membrane. Refer to MB Flashing Details section of the GAF *Application and Specifications Manual*.

3.13 BITUMINOUS BASE FLASHINGS***Cold Adhesive (Option 2)***

- A. Install GAF base flashing over all cant strips, horizontal to vertical transitions, roof edges and roof penetrations. Flashings are to be secured in accordance with current GAF application guidelines.
- B. Nailable curbs and walls must be covered with a layer of approved GAFGLAS® or Ruberoid® Base Sheet or backer ply fastened 8" (20.3 cm) o.c. in all directions with approved fasteners. All vertical laps must be 4" (10.2 cm). Base sheet or backer ply must extend out onto the field of the roof as shown in the applicable GAF construction detail.

- C. Prime all metal and masonry surfaces with asphalt primer and allow adequate drying time prior to adhering flashing plies.
- D. Backer plies installed over masonry or other non-nailable substrates must be cut into manageable lengths to ensure adequate adhesion to the cant strip and vertical surfaces without excessive voids. All vertical laps shall be 4" (10.2 cm). Backer plies shall extend onto the field of the roof as shown in the applicable GAF construction detail.
- E. The finished ply of base flashing shall be run vertically to provide a selvage edge that will aid in achieving proper adhesion at the 3" (7.6 cm) vertical laps. If the sheet is run horizontally, the vertical laps must be a minimum of 6" (15.2 cm) and the selvage edge must be removed from the sheet or fully covered by the counterflashing. The finished flashing ply must extend out onto the field of the roof as shown in the applicable GAF construction detail and must be extended a minimum of 4" (10.2 cm) beyond the edge of the prior flashing plies. The flashing must be soundly adhered to the parapet, cant area and roof surface to result in a minimum void, non-bridging construction.
- F. Base flashing heights must be a minimum of 8" (20.3 cm) and a maximum of 24" (61.0 cm) above the roofline.
- G. Use only trowel-grade modified adhesive. Apply using a trowel or wide-edged putty knife with a uniform 1/8" thickness throughout. Firmly press sheets into the adhesive, and immediately nail the top of the flashing as specified in the appropriate flashing detail.
- H. Corner membrane flashings, such as "bow ties" for outside corners and "footballs" for inside corners or other membrane reinforcements are required to ensure that base flashing corners are sealed at cant areas. An alternate method of corner reinforcing is to install a smooth MB membrane reinforcement piece on the prepared corner substrate prior to final surfacing membrane. Refer to MB Flashing Details section of the GAF *Application and Specifications Manual*.

3.14 SHEET METAL

- A. Metal should not be used as a component of base flashing. Because of the high coefficient of expansion of sheet metals and the large temperature changes that can be experienced on a roof, sheet metal or exposed metal components must be isolated from the waterproofing components of the roofing and flashing system as efficiently as possible to prevent the metal from splitting the membranes.
- B. All metal edge details scheduled to be included in the **Edge to Edge Coverage** of the Diamond Pledge™ Guarantee must be submitted and approved in writing by the manufacturer prior to project commencement.
- C. When it is unavoidable to use metal in the roofing system (i.e., lead flange at drains, gravel stops), treated wood nailers and insulation stops, 1" (25 mm) wider than the metal flange, should be provided for metal flange attachment. Metal flanges must always be set on top of the roof membrane with modified trowel grade cold adhesive applied material for SBS roof systems. The metal flange is then sealed using the applicable construction detail to meet applicable guarantee requirements. Metal accessories (gravel stops, counter flashing, etc.) should be 16 oz. (0.56 mm) copper, 24 gauge (0.71 mm) galvanized or stainless steel, 2 1/2 to 4 lb. (1.1-1.8 kg) lead, or 0.032" (0.81 mm) aluminum.

- D. Fabricate and install all sheet metal materials as shown in applicable construction details. Refer to SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.) for guidance on sheet metal treatments not addressed in this specification.
- E. Clean metal and apply asphalt primer to all sheet metal surfaces that will come into contact with asphalt or other bituminous materials; allow the primer adequate time to dry.
- F. Use fastener types compatible with the sheet metal type.
1. Copper or lead-coated copper: use copper or bronze fasteners.
 2. Lead and galvanized steel: use galvanized or cadmium-plated sheet fasteners.
 3. Aluminum: use aluminum fasteners.
 4. Stainless steel: use stainless steel fasteners.
- G. Metal counterflashing shall have a minimum 4" (10.2 cm) face with a drip lip. The bottom edge of the counterflashing shall cover the roofing membrane and/or base flashing by a minimum of 4" (10.2 cm). Metal counter flashing used for masonry walls, wooden walls, or through wall metal flashings should be a two piece design to allow for installation and later removal. Metal counter-flashings for stucco, EIFS, wood siding or similar materials should be designed appropriately, such as "Z" type flashing. End joints shall be lapped 3" (7.6 cm) or more. Adequate fasteners must be provided to secure against wind forces. Skirt fasteners shall be watertight.
- H. Metal termination bars shall be a minimum of 1/10" (3 mm) thick x 1" (25 mm) wide with preformed sealant edge lap. Bar should have 1/4" (6 mm) x 3/8" (10 mm) slotted holes on 4" (10.2 cm) centers to facilitate mechanical anchorage.
- Note: Termination bars are not suitable in all base flashing and wall flashing conditions. Termination bars may only be used in conjunction with an appropriate counterflashing extending a minimum of 4" (10.2 cm) below the termination bar.**
- I. Metal flanges for gravel stops, eave strips, and pitch pockets to be used in conjunction with roofing shall be primed (both sides), set in modified trowel grade cold adhesive applied material for SBS roof systems. Flanges shall be a minimum of 3 1/2" (8.9 cm) wide for gravel stops or eave strips and 4" (10.2 cm) wide for projections and extensions through the roof. The gravel stop lip should be at least 3/4" (19 mm) high. Eave strip lips shall be at least 3/8" (10 mm) high. Provisions must be made for securing the skirt to the face of the wall. This may be a wood nailer strip for masonry and metal construction. In all cases, gravel stop, and eave strip nailer should be fastened to the deck or deck system with adequate resistance against wind forces.
- J. Stacks shall have metal sleeve flashing a minimum of 8" (20.3 cm) high. Pitch pockets for brackets, supports, pad-eyes, etc., shall have a 4" (10.2 cm) minimum height metal sleeve.
- K. On re-roofing projects, provisions shall be made for reinstallation of existing sheet metal duct work, equipment, coping metal, and counterflashing removed in conjunction with the new work. Also, provide for cleaning and repairing of existing defective sheet metal, and replacement of missing and irreparable sheet metal to match existing types. Light gauge sheet metal flashings which are incorporated into the Ruberoid® roof system are not suitable for re-use and must be replaced with new material.
- L. Conduits and piping such as electrical and gas lines must be set on wood blocking or some other form of support. Wood blocking/supports must be set on pads constructed of an additional layer of roof membrane material.

3.15 ROOF PROTECTION

- A. Protect all partially and fully completed roofing work from other trades until completion.
- B. Whenever possible, stage materials in such a manner that foot traffic is minimized over completed roof areas.
- C. When it is not possible to stage materials away from locations where partial or complete installation has taken place, temporary walkways and platforms shall be installed in order to protect all completed roof areas from traffic and point loading during the application process.
- D. Temporary tie-ins shall be installed at the end of each workday and removed prior to commencement of work the following day.

3.16 CLEAN-UP

- A. All work areas are to be kept clean, clear, and free of debris at all times.
- B. Do not allow trash, waste, or debris to collect on the roof. These items shall be removed from the roof on a daily basis.
- C. All tools and unused materials must be collected at the end of each workday and stored properly off of the finished roof surface and protected from exposure to the elements.
- D. Dispose of or recycle all trash and excess material in a manner conforming to current EPA regulations and local laws.
- E. Properly clean the finished roof surface after completion, and make sure the drains and gutters are not clogged.
- F. Clean and restore all damaged surfaces to their original condition.

END OF SECTION

SECTION 071113 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cold applied water based emulsified asphalt dampproofing for exterior below grade foundations.
 - 2. Cold applied water based emulsified asphalt vapor retarding coating for exterior above grade planter walls.
- B. Related Sections:
 - 1. Section 03 30 00 - Cast-in-Place Concrete.

1.2 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide material complying with the following requirements:
 - 1. Nonflammable.
 - 2. VOC Content:
 - a. 0.25 pounds per gallon (30 g/L) less water and exempt solvents.
 - 3. Service Temperature Range:
 - a. Minus 40 degrees F (Minus 40 degrees C) to 150 degrees F to (66 degrees C).
 - 4. Compliance:
 - a. Brush, roller and spray applied fiber free Hydrocide 600 complying with ASTM D1187, Type 1, and ASTM D1227, Type 3, Class I.
 - b. Brush, roller and spray applied short fiber reinforced Hydrocide 700B complying with ASTM D1227, Type 2, Class I, and ASTM D1187, Type 1.

1.3 SUBMITTALS

- A. Comply with Section 01 33 00.
- B. Product Data: Submit manufacturer's technical bulletins and MSDS on each product.
- C. Submit list of project references as documented in this Specification under Quality Assurance Article. Include contact name and phone number of person charged with oversight of each project.
- D. Quality Control Submittals:
 - 1. Provide protection plan of surrounding areas and surfaces not to receive dampproofing.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer Qualifications: Company with minimum 10 years of experience in manufacturing of specified products and systems.
 - 2. Applicator Qualifications: Company with minimum of 5 years experience in application of specified products and systems on projects of similar size and scope, and is acceptable to product manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 61 00,
- B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.
- C. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements:
 - a. Keep from freezing in the container.
 - b. Do not apply at temperatures below 40 degrees F (4 degrees C) or when temperatures are expected to fall to 40 degrees F (4 degrees C) within 24 hours.
 - c. Protect from rain until coating has set.
 - d. Application shall be protected or covered within 7 days of application.
 - e. Do not expose to long-term UV.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products from the following manufacturer:
 - 1. BASF Building Systems
889 Valley Park Drive

Shakopee, MN 55379

Customer Service: 800- 433-9517

Technical Service: 800-243-6739

Direct Phone: 952-496-6000

Internet: <http://www.BASFbuildingsystems.com>
- B. Substitutions: Comply with Section 01 25 00.
- C. Specifications and Drawings are based on manufacturer's proprietary literature from BASF Building Systems. Other manufacturers shall comply with minimum levels of material, color selection, and detailing indicated in Specifications or on Drawings. Architect will be sole judge of appropriateness of substitutions.

2.2 MATERIALS

- A. Cold applied water based emulsified asphalt:
 - 1. Non-fibrated Product: Hydrocide 600 by BASF Building Systems.

2. Short-fiber Fibrated Product: Hydrocide 700B by BASF Building Systems.
- B. Protection Board: Asphalt coated fiberboard with top edge fully coated.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Protect adjacent Work areas and finish surfaces from damage during damproofing application.
- B. Surface should be free of oil, grease, dirt, laitance, and loose material. Dry surfaces shall be dampened with water and kept damp until application.

3.2 APPLICATION

A. EXTERIOR SURFACES BELOW GRADE

1. 3-Coat System:

- a. Apply prime coat of asphalt emulsion of Hydrocide 600 non-fibrated material, cut 20 percent by volume with clean water. Allow prime coat to dry tacky to touch and apply 1 coat of short fiber fibrated material.
 - b. Fill in crevices and grooves, providing continuous coating and free from breaks and pinholes. Carry coating over exposed top and outside edge of footing. Spread around joints, grooves, and slots, and into chases, corners, reveals, and soffits. Bring coating to finished grade.
 - c. Second Coat: Within 24 hours, apply Hydrocide 700B at rate of one gallon per 35 SF. Allow to dry tacky to touch.
 - d. Third Coat: Within 24 hours, apply Hydrocide 700B same as second coat. Allow at least 48 hours, but no more than 96 hours before backfilling.
 - e. Place backfill at least 24 to 48 hours after application, but within 7 days. Do not rupture or damage film or displace coating or membranes.
- B. At walls against building areas install below grade protection board immediately following curing of final coat of Hydrocide 700B. Do not allow dirt, rocks or debris between damproofing membrane and protection board. Locate top edge of protection board 1" to 2" below finish grade of earth at face of wall.

3.3 CLEANING

- A. Clean tools and equipment immediately with hot, soapy water. Cured material can be removed with solvent.
- B. Clean up and properly dispose of debris remaining on Project site related to application.
- C. Remove temporary coverings and protection from adjacent Work areas.

3.4 PROTECTION

- A. Protect application from damage during construction.

END OF SECTION 071113

SECTION 071313 – SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Modified bituminous sheet waterproofing for installation below roofing, sheet metal and plaster assemblies where indicated.
 - 2. Coordinate installation of self-adhering sheet waterproofing with installers of adjacent finisher and sheet metal flashing,

1.2 SUBMITTALS

- A. Product data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
- C. Samples: For the following products:
 - 1. 12-by-12-inch square of waterproofing and flashing sheet.
- D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- E. Qualification Data: For Installer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for waterproofing.
- G. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that is acceptable to waterproofing manufacturer for installation of waterproofing required for this Project.
- B. Source Limitations: Obtain waterproofing materials through one source from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- C. Maintain adequate ventilation during preparation and application of waterproofing materials.

PART 2 - PRODUCTS

2.1 SHEET WATERPROOFING

- A. Rubberized Asphalt Sheet: Not less than 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to a 8-mil-thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
 - 1. Products: Grace Perm-A-Barrier Wall Flashing:
 - 2. Physical Properties:
 - a. Tensile Strength: 800 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 200 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
 - d. Puncture Resistance: 80 lbf minimum; ASTM E 154.
 - e. Hydrostatic-Head Resistance: 150 feet minimum; ASTM D 5385.

- f. Water Absorption: 0.10 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - g. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.
3. Provide at all exterior wall door, window, louver openings and miscellaneous wall penetrations.

2.2 ROOF UNDERLAYMENT WATERPROOFING

- A. Butyl Rubber Sheet: Not less than 30-mil- thick, cold applied, self-adhering sheet consisting a high density, cross laminated, polyethylene on one side with a butyl rubber adhesive film with release liner on adhesive side. Polyethylene surface is embossed slip resistance. Material is formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
- 1. Products: Grace Ultra Underlayment:
 - 2. Physical Properties:
 - a. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 250 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
 - d. Adhesion to plywood 3.0 lbs./in width ASTM D903.
 - e. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.
 - f. Service Temperature: 300 degrees F per ASTM D1204.
 - 3. Provide below all metal roofing, edge flashing, valley, hip & ridge flashing and cap flashing as noted on drawings.

2.3 ROOF UNDERLAYMENT WATERPROOFING

- A. Butyl Rubber Sheet: Not less than 40-mil- thick, cold applied, self-adhering sheet consisting a high density, cross laminated, polyethylene on one side with a butyl rubber adhesive film with release liner on adhesive side. Polyethylene surface is embossed slip resistance. Material is formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
- 1. Products: Grace Ice & Water Shield HT Underlayment:

2. Physical Properties:

- a. Tensile Strength: MD 33 I6/IN CD 31 16/IN; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 250 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
 - d. Adhesion to plywood 5.0 lbs./in width ASTM D903.
 - e. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.
 - f. Service Temperature: 300 degrees F per ASTM D1204.
3. Provide below all metal roofing, edge flashing, valley, hip & ridge flashing and cap flashing as noted on drawings.

2.4 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Substrate Patching Membrane: Low-viscosity, two-component. asphalt- modified coating.
- E. Sheet Strips: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing.
- F. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application. Obtain IOR inspection and acceptance of structural plywood decks and shear panels prior to beginning membrane installation.
- B. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- C. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM 0 4258.
- D. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
- E. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 SHEET AND UNDERLAYMENT WATERPROOFING APPLICATION

- A. Install waterproofing sheets and underlayment according to waterproofing manufacturer's written instructions and according to recommendations in ASTM D 6135. Provide sheet waterproofing over sheathed exterior walls that are outward sloped for protection of the sheathing below plaster assemblies and in conjunction with sheet metal flashing at all wall openings and terminations. Provide roof underlayment waterproofing below all sheet metal roofing, roof flashing and roof caps.
- B. Apply primer to required substrates at required rate and allow to dry. Limit priming to areas that will be covered by waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 3-1/2-inch- minimum side lap widths and 6" minimum end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
 1. When ambient and substrate temperatures range between 25 and 40deg F, install self-adhering, modified bituminous sheets produced for low temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

- D. Horizontal Application: Apply sheets from low point to high point of roof decks to ensure that side laps shed water.
- E. Apply continuous sheets over sheet metal strips bridging substrate cracks, construction, and contraction joints.
- F. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic.
- G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.
- H. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

3.4 PROTECTION AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071313

SECTION 072100 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concealed building thermal insulation.
 - 2. Sound attenuation insulation at wall and ceiling assemblies indicated.
 - 3. Vapor Retarder
- B. Related Sections:
 - 1. Division 6 Sections "Rough Carpentry" and "Miscellaneous Carpentry."
 - 2. Divisions 20 through 23 for pipe and duct insulation.

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Fire Resistance Rating: ASTM E119.
- C. Thermal and Sound-insulating materials shall comply with CBC Section 719 and have a flame spread index of not more than 25 and a smoke-developed index of not more than 450 (including vapor retarders).

1.4 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 GLASS-FIBER BATT/BLANKET INSULATION

- 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. CertainTeed Corporation.
 - 2. Guardian Building Products, Inc.

3. Johns Manville.
 4. Knauf Insulation.
 5. Owens Corning.
- B. Unfaced, Glass-Fiber Thermal Batt/Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. The width of batts shall provide for a snug fit between framing members.
1. R-19: At all exterior 6" metal framed walls, use with separate vapor retarder.
 2. R-19: At interior walls between conditioned and unconditioned space.
- C. Unfaced, Glass-Fiber Sound Isolating Insulation: ASTM C 665, Type I (for metal framing), unfaced.
1. 3" minimum thickness by width to provide a snug fit between wall framing below and above ceiling levels.
 2. Provide at interior walls indicated in drawings except at walls between conditioned and unconditioned space.
- F. Verify type of insulation required to suit wood or metal materials and framing conditions and to securely hold in place and provide best product available, subject to approval of Architect.

2.2 OTHER INSULATION TYPES

- A. Spray-on Cellulose Fiber Acoustic Insulation.
1. Celbar, 1-1/2" minimum thickness, STC 51 minimum rating at plumbing walls and in sound walls where tight, broken up spaces are difficult to insulate with batts.

2.3 VAPOR RETARDERS

- A. Reinforced-Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft., with maximum permeance rating of 0.0507 perm.
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. Raven Industries Inc.; DURA-SKRIM 6WW.
 - b. Reef Industries, Inc.; Griffolyn T-65.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, use NT related to exposure, and Use O related to vapor-barrier-related substrates.

2.4 BATT/BLANKET 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.
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. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.

- b. Gemco; Spindle Type.
 2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
 - B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
 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. AGM Industries, Inc.; SC150.
 - b. Gemco; S-150.
 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Attic spaces.
 - C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
 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. AGM Industries, Inc.; TACTOO Adhesive.
 - b. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 PREPARATION & SCOPE

- A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.
- B. Select the best insulation type and R-Value to suit building conditions and to provide a contiguous thermal envelope with minimum R-19 at perimeter walls full height up to R-30 minimum at roof deck or ceiling (at ventilated attics where indicated). Obtain direction from Architect in advance where conditions are not clear.

3.2 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.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber Batt/Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
 - a. With faced batt/blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
- C. Set vapor retard faced units with facing toward the warm side of construction except as otherwise indicated. Do not obstruct ventilation spaces, except for fire blocking.
 - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure air-tight installation.
- D. Apply Celbar spray-on acoustical insulation in accordance with manufacturer's recommendations to the inner face of drywall, plywood sheathing or other wall finish to proper thickness within wall cavity between studs, sealing tightly around structural, plumbing and electrical piping/devices within wall. Allow proper drying time before installing second face of drywall.

3.4 INSTALLATION OF VAPOR RETARDERS

- A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
 - 1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.5 PROTECTION

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

END OF SECTION 072100

SECTION 072500 - CONCRETE SLAB VAPOR EMISSIONS TREATMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Spray applied concrete sealer system.
- B. Install Vapor Emission Treatment Systems where tests reveal presence of more than acceptable moisture and alkali levels in accordance with Test method ASTM F 1869 or ASTM F 2170.
- C. Related Sections
 - 1. Section 03 30 00, Cast-in Place Concrete.
 - 2. Section 03 39 00, Concrete Curing.
 - 3. Division 09 sections for floor finishes that require maximum moisture and alkali levels.

1.2 PERFORMANCE REQUIREMENTS

- A. Vapor emissions floor treatment shall reduce vapor emissions from on-grade slabs to levels satisfactory to resilient flooring manufactures requirements and warranties.
- B. Vapor emission floor treatment shall prevent negative side moisture migration through concrete floor and shall allow for all types of flooring surface treatment systems.
- C. Vapor emission floor treatment shall be alkali-neutralizing and shall penetrate into concrete materials and chemically form protective crystalline barrier between surface. Inner barrier so formed shall not be affected by Ultra-violet light, abrasion and chemicals and shall permanently seal and waterproof concrete against harmful effects of water intrusion, freeze-thaw cycle damage, de-icing salts and chloride migration.

1.3 SUBMITTALS

- A. Product data describing physical and performance characteristics.
- B. Manufacturers written installation instructions.
- C. Manufacturer's certificate indicating applicator is accepted installer.

- D. Moisture vapor emission test results. Indicate environmental conditions, installation procedures used, deficiencies and corrective actions taken for filler, vapor emissions coating and membrane.

1.4 SYSTEM DESCRIPTION

- A. Sealer/Hardener/Vapor Barrier compound, with minimum of 5 years documented experience to control moisture vapor emission, having 34 percent solid content, compatible with all flooring material, adhesives, bond breakers and Overlayments. Complying with STM C-309, ASTM C-1315. Surface treatment applied on new cured and existing slabs receiving new resilient flooring, sheet vinyl and vinyl composition tile, rubber tile, wood flooring, carpet, and resinous flooring.

1.5 QUALITY ASSURANCE

- A. Applicator: Company approved and certified by vapor emission floor treatment manufacturer.
- B. Requirements of Regulatory Agencies: Materials used in formulation of product shall conform to all local, State, and Federal air quality and environmental control standards.
- C. Pre-installation Conference
 1. Pre-installation meeting: Schedule before installing concrete floor slabs.
 2. Required Attendees: Contractor's representative, Architect's representative, Owner's representative, Manufacturer's representative, Subcontractor, Installer.
 3. Convene before installation of concrete.
 4. Advise Contractor of all Warranty requirements.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver material in original sealed containers, clearly marked with manufacturer's name and brand name.
- B. Store materials in accordance with manufacturer's recommendations.

1.7 WARRANTY

- A. Submit under provisions of Division 01, General Requirements.
- B. Provide 15-year Full System warranty issued to the Owner of the facility covering all labor and materials needed to replace all floor covering that fails due to concrete moisture vapor emission and moisture born contaminants such as alkalinity.
 1. Issue a certificate of insurance in amount of \$2,500,000.00
- C. Include all costs for replacement of failed flooring material installed over moisture seal membrane, cracks, joints and holes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products of following manufacturers form basis for design and quality intended.
 - 1. Creteseal, Anaheim, CA Product: CS 2000
 - 2. Or equal as approved prior to bid opening in accordance with Division 1, Section Substitution Procedures for substitution requests submitted at least 14 days prior to date for bid opening.

2.2 MATERIALS

- A. Vapor Emission floor Treatment: Silicate-based or epoxy-based solution to penetrate on-grade concrete floor surfaces to form protective crystalline moisture barrier.
- B. Accessory Materials: As recommended by manufacturer/or intended application.
- C. Verify floor treatment product is compatible with flooring material and adhesive. Provide letter or other documentation from flooring manufacturer that floor treatment product is acceptable for use with their flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Manufacturer's representative shall be on site to document and oversee the entire installation process.
- B. Verify surfaces are dry and free of dirt and contaminates.
- C. Verify moisture and alkalinity tests have been conducted per ASTM F 1869 or ASTM F 2170.
- D. Verify existing concrete conditions are suitable to receive the Work of this Section.
- E. Repair concrete where required according to manufacturer's recommendations.
- F. Do not begin application until unsuitable conditions have been corrected, and control joints have been sawcut. Sawcut of control joints after installation of treatment will not be accepted. Tool joints where indicated prior to installation of treatment.
- G. Beginning of Installation means acceptance of existing substrate and site conditions.

3.2 PREPARTION

- A. Prepare surface by removal of laitance, grease, adhesives, unapproved patching compounds and foreign matter from existing concrete. Use mechanical means (scarifing or bead blasting) where required for existing slabs.

- B. Thoroughly clean all cracks. Apply to structurally sound concrete surfaces, free of voids and cracks. If needed apply cementitious patch or approved epoxy filler to any voids or cracks. Groove out all cracks/control joints and fill with an approved patching compound.
- C. Clean expansion joints and control joints as required.
- D. Maintain building temperature above 65 degrees Fahrenheit for a period of 48 hours prior to start of installation to start of installation of base coat.

3.3 APPLICAITON

- A. Apply the products according to the manufacturer's instructions.
- B. Manufacturer technician will be on site the day of the concrete pour at the beginning of the Work to install or train in application, document and return on every application thereafter to verify that proper procedures are followed.
- C. Apply concrete Surface Treatment CS2000 / Sealer / Hardener/ Curing Compound after calcium chloride test and subsequent results have been performed as soon as harsh weather permits, prior to any other chemical treatments for concrete slabs either on grade, below grade or above grade receiving resilient flooring such as sheet vinyl, vinyl composition tile, rubber, wood flooring, carpet, epoxy coatings and overlays.
- D. Apply CS2000 to the concrete slabs as soon as final finishing operations are complete, control joints are tooled and concrete has hardened sufficiently to sustain foot traffic without damage.
- E. Spray Apply CS2000 at the rate of 200 square feet per gallon. If puddling or bird bathing occurs, lightly broom product evenly over the substrate until product has completely penetrated the surface.
- F. If within 2 hours after initial application areas are subjected to heavy rainfall and puddling occurs, reapply CS2000 product to these areas as soon as weather condition permits.

3.4 TESTING

- A. Moisture test per ASTM F 1869 or ASTM F 2170 after installation of system.
 - 1. ASTM F1869: 3 – 5 lbs.
 - 2. ASTM F2170: 75%
 - 3. ASTM F710: Alkalinity test: less than 90pH.

3.5 PROTECTION

- A. Prohibit traffic on finish floor surface prior to installation of finish floor covering.

END OF SECTION 072500

SECTION 07 41 13 - INSULATED METAL ROOF PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Foamed-insulation-core lap seam exposed fastener metal roof panels, with related metal trim and accessories.

1.2 RELATED REQUIREMENTS

- A. Division 05 Section "Structural Steel Framing" for steel framing supporting metal panels.
- B. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.
- C. Division 07 Section "Metal Wall Panels" for factory-formed metal wall and soffit panels.
- D. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal copings, flashings, reglets and roof drainage items in addition to items specified in this Section.
- E. Division 07 Section "Roof Accessories" for roof hatches, smoke vents, equipment curbs, and equipment supports.
- F. Division 07 Section "[Joint Sealants](#)" for field-applied [Joint Sealants](#).
- G. Division 13 Section "Metal Building Systems" for steel framing supporting metal panels.

1.3 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA): www.aamanet.org:
 - 1. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
- B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International (ASTM): www.astm.org:
 - 1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 3. ASTM A 792 - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

4. ASTM A 666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 5. ASTM C 518 - Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 6. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
 7. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.
 8. ASTM D 1622 - Apparent Density of Rigid Cellular Plastics.
 9. ASTM D 1623 – Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
 10. ASTM D 2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
 11. ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
 12. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
 13. ASTM D 6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics
 14. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
 15. ASTM E 84 - Test Methods for Surface Burning Characteristics of Building Materials.
 16. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 17. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
 18. ASTM E 2357 – Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies
 19. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
 20. ASTM E 1680 - Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems.
 21. ASTM E 1980 - Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- D. Cool Roof Rating Council (CRRC): www.coolroofs.org/productratingprogram.html:
1. CRRC-1-2008 – CRRC Product Rating Program.

1.4 QUALITY ASSURANCE

- A. Manufacturer/Source: Provide metal roof panel assembly and accessories from a single manufacturer approved under an accredited third-party quality control program.
- B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum five years' experience in manufacture of similar products in successful use in similar applications.

1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
 - a. Product data, including certified independent test data indicating compliance with requirements.
 - b. Samples of each component.
 - c. Sample submittal from similar project.
 - d. Project references: Minimum of five installations not less than five years old, with Owner and Architect contact information.
 - e. Sample warranty.
 - f. Certificate from an accredited third-party quality control program.
 2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
 3. Approved manufacturers must meet separate requirements of Submittals Article.
- C. Installer Qualifications: Experienced Installer with minimum of five years' experience with successfully completed projects of a similar nature and scope.
1. Installer's Field Supervisor: Experienced mechanic supervising work on site whenever work is underway.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, metal panel installer, metal panel manufacturer's technical representative, inspection agency, and related trade contractors.
1. Coordinate building framing in relation to metal panel system.
 2. Coordinate openings and penetrations of metal panel system.
 3. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.6 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for specified products.
- B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, curbs, vents, snow guards, lightning arresting equipment, and special details. Make distinctions between factory and field assembled work.
1. Include data indicating compliance with performance requirements.
 2. Indicate points of supporting structure that must coordinate with metal panel system installation.
 3. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.

- C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.
- D. Samples for Verification:
 - 1. Provide 12-inch-long section of each metal panel profile.
 - 2. Provide color chip verifying color selection.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Indicating compliance of products with requirements.
- B. Qualification Information: For Installer firm and Installer's field supervisor.
- C. Accreditation Certificate: Indicating that manufacturer is accredited under an accredited third-party quality control program.
- D. Warranty:
 - 1. Submit manufacturer's written two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion excluding coil coatings (paint finishes) that are covered under a separate warranty.
 - 2. The installation contractor shall issue a separate warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components, or other damage. Protect panels and trim bundles during shipping. Protect painted surfaces with a protective covering before shipping.
 - 1. Deliver, unload, store, and erect metal panels and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
 - 2. Store in accordance with Manufacturer's written instructions. Provide wood collars for stacking and handling in the field.
 - 3. Shield foam insulated metal panels from direct sunlight until installation.

1.10 WARRANTY

- A. Special Manufacturer's Warranty: Submit Manufacturer's two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion excluding coil coatings (paint finishes) that are covered under a separate warranty.

- B. The installation contractor shall issue a separate warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.
- C. Special Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within [25] years from date of Substantial Completion, including.
 - 1. Fluoropolymer Two-Coat System:
 - a. Color fading in excess of [5] or [10] for copper, silver metallic and bright red; Hunter units per ASTM D 2244.
 - b. Chalking in excess of [6] for copper, silver metallic and bright red or [8] rating per ASTM D 4214.
 - c. Failure of adhesion, peeling, checking, or cracking.
 - 2. Modified Silicone-Polyester Two-Coat System:
 - a. Color fading in excess of [5] or [7] for crimson red; Hunter units per ASTM D 2244.
 - b. Chalking in excess of [7] for crimson red or [8] rating per ASTM D 4214.
 - c. Failure of adhesion, peeling, checking, or cracking.
 - 3. Other finish options available; additional information can be found at metlspan.com or contact Metl-Span at 972.221.6656.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Manufacturer: Metl-Span, a Nucor company; Lewisville, Texas
Tel: 972.221.6656; Email: info@metlspan.com; Web: metlspan.com.
 - 1. Provide basis of design product, or comparable product approved by Architect prior to bid.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.
- B. Roof Panel Radiative Property Performance:
 - 1. **Cool Roof Rating Council:** Listed in CRRC Rated Product Directory, with minimum properties as required by applicable Energy efficiency or High-Performance Green Building standard.
- C. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E 72 or ASTM E 1592 applied in accordance with IES AC 04, Section 4, Panel Load Test Option or Section 5, Panel Analysis Option:

1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
 - a. Roof Panel Wind Uplift Testing: Certify capacity of metal panels by testing of proposed assembly per ASTM E 72 or ASTM E 1592.
 2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/240 of the span with no evidence of failure.
 3. Seismic Performance: Comply with ASCE 7, Section 9, "Earthquake Loads."
- D. Fire Performance Characteristics: Provide metal panel systems with the following fire-test characteristics determined by indicated test standard as applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.
1. Surface-Burning Characteristics: Provide metal panel systems with the following characteristics when tested per ASTM E 84. The core shall have:
 - a. Flame spread index: 25 or less.
 - b. Smoke developed index: 450 or less.
- E. Roof Panel Air Infiltration, ASTM E 1680:
1. Maximum 0.014 cfm/sq. ft. at static-air-pressure difference of 12 lbf/sq. ft.
- F. Roof Panel Water Penetration Static Pressure, ASTM E 1646: No uncontrolled water penetration at a static pressure of 20 lbf/sq. ft.
- G. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.
- H. Thermal Performance: When tested in accordance with ASTM C 518, the panels shall provide a K-factor 0.112 btu/sf/hr/deg F at a 35° F mean temperature.

2.3 INSULATED METAL ROOF PANELS

- A. Lap Seam, Exposed Fastener, Foamed-Insulation-Core Metal Wall and Roof Panels: Structural metal panels consisting of exterior metal sheet with three major tapered ribs and two minor ribs between each major rib, and interior metal sheet, with factory foamed-in-place polyisocyanurate core in thermally separated profile, with tongue-and-groove panel edges, attached to supports using exposed fasteners.
1. Basis of Design: Metl-Span, **LS-36**
 2. **AZ-50 Aluminum-Zinc Alloy-Coated Steel Sheet:** ASTM A 792/A 792M, structural quality, Grade 50, Coating Class AZ-55 unpainted Galvalume Plus coating.
 3. Exterior Face Sheet: **24 gauge** coated thickness, with **stucco embossed surface**.
 - a. Finish: **Fluoropolymer two-coat system.**

- b. Color: As selected by Architect from manufacturer's standard colors.
- 4. Interior Face Sheet: **26 gauge** coated thickness, with **stucco embossed surface** and **mesa profile**.
 - a. Finish: **Modified silicone-polyester two-coat system**.
 - b. Color: As selected by Architect from manufacturer's standard colors.
- 5. Panel Width: **36 inches**.
- 6. Panel Thickness: **4 inches**.
- 7. Insulating Core: Polyisocyanurate with zero ozone depletion potential blowing agent
 - a. Closed Cell Content: 90% or more as determined by ASTM D 6226
 - b. Compressive Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM D 1621
 - c. Shear Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM C 273
 - d. Tensile Strength: As required to meet structural performance requirements and with a minimum of 16 psi ASTM D 1623
 - e. Minimum Density: 2.0 pcf as determined by ASTM D 1622
 - f. **Thermal Resistance (R-Value): 24.33** deg. F * hr * sq. ft./Btu as determined by ASTM C 518 at 35 degrees Fahrenheit mean temperature.
- 8. **Thermal Transmittance Coefficient (U-factor): 0.0411** Btu/hr * sq. ft. * deg. F insert corresponding value as determined by ASTM C 1363 at 35 degrees Fahrenheit mean temperature. Tested specimen must include at least two engaged side joints.

2.4 METAL ROOF PANEL ACCESSORIES

- A. General: Provide complete metal panel assemblies incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.
- B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.
- C. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Provide corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.
- D. Joint Sealers: Provide Tape Mastic Sealants, Concealed [Joint Sealants](#), and Urethane [Joint Sealants](#) per Section 07 92 00, "[Joint Sealants](#)".

2.5 FABRICATION

- A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.
- B. Fabricate metal panel joints configured to accept sealant tape providing weather-tight seal and preventing metal-to-metal contact and minimizing noise resulting from thermal movement.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.6 FINISHES

- A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- B. Exterior Face Sheet Coil-Coated Finish System
 - 1. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, [meeting solar reflectance index requirements].
 - a. Basis of Design: Metl-Span, Fluoropolymer.
- C. Interior Face Sheet Coil-Coated Finish System:
 - 1. Silicone-Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat
 - a. Basis of Design: Metl-Span, Silicone Polyester

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.
 - 1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.
 - 2. Panel Support Tolerances: Confirm that metal panel supports are within tolerances acceptable to metal panel manufacturer but not greater than the following:
 - a. 1/14 inch in 20 foot in any direction.
 - b. 3/8 inch over any single roof plane.
 - c. At Purlin Spacing 7 feet or less: 1/8 inches, out only.
- B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

3.2 METAL PANEL INSTALLATION

- A. Lap-Seamed, Exposed-Fastener Foamed-Insulation-Core Metal Panels: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.
- B. Attach panels to metal framing using screws, fasteners, sealants, and adhesives recommended for application by metal panel manufacturer.
 - 1. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer.
 - 2. Cut panels in field where required using manufacturer's recommended methods.
 - 3. Provide weatherproof jacks for pipe and conduit penetrating metal panels.
 - 4. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.
- C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealers.
- D. Joint Sealers: Install tape sealers and liquid sealants where indicated and where required for weatherproof performance of metal panel assemblies.
 - 1. Seal panel base assembly, openings, panel head joints, and perimeter joints using joint sealers indicated in manufacturer's instructions.
 - 2. Seal wall and roof panel joints utilizing tape sealer and vapor seal bead of non-curing butyl.
 - 3. Prepare joints and apply sealants per requirements of Division 07 Section "[Joint Sealants](#)."

3.3 ACCESSORY INSTALLATION

- A. General: Install metal panel accessories with positive anchorage to building and weathertight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
 - 2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
 - 3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage an independent testing and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective films immediately in accordance with metal panel manufacturer's instructions. Clean finished surfaces as recommended by metal panel manufacturer.
- B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 07 42 13 – INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Foamed-insulation-core concealed fastener metal wall panels, with related metal trim and accessories.

1.2 RELATED REQUIREMENTS

- A. Division 05 Section "Structural Steel Framing" for steel framing supporting metal panels.
- B. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.
- C. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing items in addition to items specified in this Section.
- D. Division 07 Section "Metal Roof Panels" for factory-formed metal wall, roof, and soffit panels.
- E. Division 13 Section "Metal Building Systems" for steel framing supporting metal panels.

1.3 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA): www.aamanet.org:
 - 1. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
- B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International (ASTM): www.astm.org:
 - 1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 3. ASTM A 792 - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 4. ASTM A 666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
 - 5. ASTM C 518 - Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 6. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
 - 7. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.
 - 8. ASTM D 1622 - Apparent Density of Rigid Cellular Plastics.

9. ASTM D 1623 – Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
 10. ASTM D 2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
 11. ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
 12. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
 13. ASTM D 6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics
 14. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
 15. ASTM E 84 - Test Methods for Surface Burning Characteristics of Building Materials.
 16. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 17. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
 18. ASTM E 2357 – Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies
- D. National Fire Protection Association (NFPA)
1. NFPA 259 – Test Method for Potential Heat of Building Materials.
 2. NFPA 285 – Evaluation of Fire Propagation Characteristics of Exterior Non-Load Bearing Wall Assemblies.
 3. NFPA 286 – Fire Test of Evaluating Conditions of Wall and Ceiling Finish to Roof Fire Growth.
- E. FM Global (FM): www.fmglobal.com:
1. FM 4880 American National Standard for Evaluating Insulated Wall and Roof/Ceiling Assemblies

1.4 QUALITY ASSURANCE

- A. Manufacturer/Source: Provide metal panel assemblies and accessories from a single manufacturer approved under an accredited third-party quality control program
- B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum ten years' experience in the manufacturing of similar products and successful use in similar applications.
1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
 - a. Product data, including certified independent test data indicating compliance with requirements.
 - b. Samples of each component.
 - c. Sample submittal from similar project.
 - d. Project references: Minimum of five installations not less than five years old, with Owner and Architect contact information.

- e. Sample warranty.
- f. Certificate from an accredited third-party Quality Control Program.
- 2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements
- 3. Approved manufacturers must meet separate requirements of Submittals Article.
- C. Installer Qualifications: Experienced Installer [certified by metal panel manufacturer] with minimum of five years' experience with successfully completed projects of a similar nature and scope.
 - 1. Installer's Field Supervisor: Experienced mechanic [certified by metal panel manufacturer] supervising work on site whenever work is underway.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, metal panel installer, metal panel manufacturer's technical representative, inspection agency and related trade contractors.
 - 1. Coordinate building framing in relation to metal panel system.
 - 2. Coordinate openings and penetrations of metal panel system.

1.6 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for specified products.
- B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.
 - 1. Include data indicating compliance with performance requirements.
 - 2. Indicate points of supporting structure that must coordinate with metal panel system installation.
 - 3. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.
- C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.
- D. Samples for Verification:
 - 1. Provide 12-inch- long section of each metal panel profile.
 - 2. Provide color chip verifying color selection.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Results: Indicating compliance of products with requirements.
- B. Qualification Information: For Installer
- C. Accreditation Certificate: Indicating that manufacturer is accredited under an accredited third-party Quality Control Program, including IAS AC472 and based upon chapter 17 of the International Building Code (IBC).

- D. Buy American Certification: Manufacturers' letters of compliance acceptable to authorities having jurisdiction, indicating products comply with requirements.
- E. Warranty:
 - 1. Submit manufacturer's written two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion excluding coil coatings (paint finishes) that are covered under a separate warranty.
 - 2. The installation contractor shall issue a separate warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping. Protect painted surfaces with a protective covering before shipping.
 - 1. Deliver, unload, store, and erect metal panels and accessory items without deforming panels or exposing panels to surface damage from weather or construction operations.
 - 2. Store in accordance with Manufacturer's written instructions.
 - 3. Shield foam insulated metal panels from direct sunlight until all components are installed.

1.10 WARRANTY

- A. Special Manufacturer's Warranty: Submit Manufacturer's two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion excluding coil coatings (paint finishes) that are covered under a separate warranty.
- B. The installation contractor shall issue a separate warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.
- C. Special Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within [25] years from date of Substantial Completion, including.
 - 1. Fluoropolymer Two-Coat System:
 - a. Color fading in excess of [5] or [10] for copper, silver metallic and bright red; Hunter units per ASTM D 2244.
 - b. Chalking in excess of [6] for copper, silver metallic and bright red or [8] rating per ASTM D 4214.
 - c. Failure of adhesion, peeling, checking, or cracking.
 - 2. Modified Silicone-Polyester Two-Coat System:

- a. Color fading in excess of [5] or [7] for crimson red; Hunter units per ASTM D 2244.
 - b. Chalking in excess of [7] for crimson red or [8] rating per ASTM D 4214.
 - c. Failure of adhesion, peeling, checking, or cracking.
3. Other finish options available; additional information can be found at metlspan.com or contact Metl-Span at 972.221.6656.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Manufacturer: Metl-Span, a Nucor company; Lewisville, Texas
Tel: 972.221.6656; Email: info@metlspan.com; Web: metlspan.com.
- B. Provide basis of design product [, or comparable product approved by Architect prior to bid].

2.2 PERFORMANCE REQUIREMENTS

- A. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.
- B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E 72 applied in accordance with ICC AC 04, Section 4, Panel Load Test Option or Section 5, Panel Analysis Option:
 1. Wind Loads: Determine loads based on applicable building code, wind speed, importance factor, exposure category, and internal pressure coefficient indicated on drawings.
 2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/240 of the span with no evidence of failure.
- C. Fire Performance Characteristics: Provide metal panel systems with the following fire-test characteristics determined by indicated test standard as applied by testing and inspection agency acceptable to authorities having jurisdiction.
 1. Surface-Burning Characteristics: The insulating core shall have been tested per ASTM E 84. The core shall have:
 - a. Flame spread index: 25 or less.
 - b. Smoke developed index: 450 or less.
 2. Room Test Performance: FM Global 4880: The panel assembly shall not support a self-propagating fire which reaches any limits of the 50' high corner test structure as evidenced by flaming or material damage of the ceiling of the assembly.
 3. Fire Propagation: The fire assembly shall meet the requirements of the standard for NFPA 285
 4. Fire Growth: The fire assembly shall meet the requirements of the standard for NFPA 286
 5. Potential Heat: Determined in accordance with NFPA 259

6. IBC Chapter 26: Panel Performance under the above test methods, shall meet the requirements of IBC, Chapter on foam plastics.
- D. Air Infiltration, ASTM E 283:
- E. < 0.01 cfm/ft² air infiltration rate at static pressure differential of 6.24 psf. Water Penetration Static Pressure:
 1. ASTM E 331: No uncontrolled water penetration at a static pressure of 15 lbf/sq. ft. for 15 minutes.
 2. ASTM E 331 Modified (2-hour duration): No uncontrolled water penetration at a static pressure of 6.24 lbf/sq. ft.
- F. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.
- G. Thermal Performance: When tested in accordance with ASTM C 518, Measurement of Steady State thermal Transmission, the panels shall provide a k factor of 0.112 btu-in/hr-sf-deg F at a 35° F (1.67° C) mean temperature.

2.3 INSULATED METAL WALL PANELS

- A. Concealed Fastener, Insulated Metal Wall Panels with foam core: Structural metal panels consisting of exterior metal sheet and interior metal sheet with matching 4 by 1/8-inch o.c. profile. Factory foamed-in-place polyisocyanurate core, with tongue-and-groove panel edges, attached to supports using concealed fasteners.
 1. Basis of Design: Metl-Span, **CF Mesa**
 2. AZ-50 aluminum-zinc alloy coated steel, conforming to ASTM A 792/A 792M, minimum grade 33, pre-painted by the coil-coating process per ASTM A 755/A 755M.
 3. Exterior Face Sheet: **26 gauge** thickness, with **stucco embossed surface**.
 - a. Finish: Fluoropolymer two-coat system.
 - b. Color: As selected by Architect from manufacturer's standard colors.
 4. Interior Face Sheet: **26 gauge** thickness, with **stucco embossed surface**.
 - a. Finish: Modified silicone-polyester two-coat system.
 - b. Color: As selected by Architect from manufacturer's standard colors.
 5. Panel Width: **36 inches**.
 6. Panel Thickness: **2.5 inch**.
 7. Insulating Core: Polyisocyanurate with zero ozone depletion potential blowing agent
 - a. Closed Cell Content: 90% or more as determined by ASTM D 6226
 - b. Compressive Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM D 1621

- c. Shear Strength: As required to meet structural performance requirements and with a minimum of 20 psi as determined by ASTM C 273
 - d. Tensile Strength: As required to meet structural performance requirements and with a minimum of 16 psi ASTM D 1623
 - e. Minimum Density: 2.0 pcf as determined by ASTM D 1622
 - f. **Thermal Resistance R-Value: 15.873** deg. F * hr * sq. ft./Btu per ASTM C 518 at 35 degrees Fahrenheit mean temperature.
8. **Thermal Transmittance (U-factor) 0.063** Btu/hr * sq. ft. * deg. F as determined by ASTM C 1363 at 35 degrees Fahrenheit mean temperature. Tested specimen must include at least two engaged side joints.

2.4 METAL WALL PANEL ACCESSORIES

- A. General: Provide complete metal panel assemblies incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.
- B. Flashing and Trim: Match material, thickness, and finish of metal panels.
- C. Panel Clips: ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, one-piece, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.
- D. Panel Fasteners: Self-drilling or Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.
- E. Joint Sealers:
 - 1. Sealants: Provide Tape Mastic Sealants, Non-skinning sealants, and Urethane Sealants in accordance with manufacturers' standards
 - 2. Vertical Joint Gasket: Manufacturers standard EPDM gasket. Color: custom color.

2.5 FABRICATION

- A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.
- B. Fabricate metal panel joints configured to accept sealant providing weathertight seal.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.6 FINISHES

- A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.

- B. Exterior Face Sheet Coil-Coated Finish System
 - 1. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 – 0.8 mil 70 percent PVDF fluoropolymer color coat, [meeting solar reflectance index requirements].
 - a. Basis of Design: Metl-Span, Fluoropolymer.
- C. Interior Face Sheet Coil-Coated Finish System
 - 1. Silicone-Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat
 - a. Basis of Design: Metl-Span, Silicone Polyester

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.
 - 1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.
 - 2. Panel Support Tolerances: Confirm that metal panel supports are within tolerances acceptable to metal panel manufacturer but not greater than the following:
 - a. 1/4-inch in 20 foot in any direction.
 - b. 3/8-inch over any single wall plane.
 - c. Girt Spacing 8 feet or more: 1/4-inch out only.
 - d. Girt Spacing Less Than 8 feet: 1/8-inch out only.
 - e. CF Architectural girt spacing less than 4 feet: 1/16-inch out only.
- B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

3.2 METAL PANEL INSTALLATION

- A. Concealed-Fastener Insulated Metal Panels with foam core: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.
- B. Attach panels to metal framing using screws, fasteners, sealants, and adhesives recommended for application by metal panel manufacturer.
 - 1. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer.
 - 2. Cut panels in field where required using manufacturer's recommended methods.

3. Provide weatherproof jacks for pipe and conduit penetrating metal panels.
 4. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.
- C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealers
- D. Joint Sealers: Install sealants where indicated and where required for weatherproof performance of metal panel assemblies
1. Seal panel base assembly, openings, panel head joints, and perimeter joints using sealants indicated in manufacturer's instructions
 2. Seal wall panel joints; apply continuously without gaps in accordance with manufacturer's written instructions, approved shop drawings, and project drawings.
 3. Prepare joints and apply sealants per requirements of Division 07 Section.

3.3 ACCESSORY INSTALLATION

- A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
 2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
 3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage an independent testing and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports.
- B. Water-Spray Test: After completing portion of metal panel assembly including accessories and trim, test 2-bay area selected by Architect for water penetration, according to AAMA 501.2.

3.5 CLEANING AND PROTECTION

- A. Remove temporary protective films immediately in accordance with metal panel manufacturer's instructions. Clean finished surfaces as recommended by metal panel manufacturer.
- B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 07 42 93 – SOFFIT AND LINER PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Flush-profile, concealed fastener, lap-seam metal soffit and liner panels, with related metal trim and accessories.

1.2 RELATED REQUIREMENTS

- A. Division 05 Section "Structural Steel Framing" for steel framing supporting metal panels.
- B. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.
- C. Division 07 Section "Thermal Insulation" for thermal insulation installed under metal panels.
- D. Division 07 Section "Air Barriers" for air barriers within metal panel assembly and adjacent to metal panel assembly.
- E. Division 07 Section "Metal Roof Panels" for metal roof panels installed with metal soffit and liner panels.
- F. Division 07 Section "Metal Wall Panels" for metal wall panels installed with metal soffit and liner panels.
- G. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing items in addition to items specified in this Section.
- H. Division 13 Section "Metal Building Systems" for steel framing supporting metal panels.

1.3 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA): www.aamanet.org:
 - 1. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.
 - 2. AAMA 809.2 Voluntary Specification Non-Drying Sealants.
- B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

- C. ASTM International (ASTM): www.astm.org:
 - 1. ASTM A755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 - 2. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 3. ASTM C920 - Specification for Elastomeric Joint Sealants.
 - 4. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
 - 5. ASTM D4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
 - 6. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
- D. International Accreditation Service (IAS):
 - 1. IAS AC472 Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems, Part B.

1.4 QUALITY ASSURANCE

- A. Manufacturer/Source: Provide metal panel assemblies and accessories from a single manufacturer accredited under IAS AC472, Part B.
- B. Installer Qualifications: Experienced Installer certified by metal panel manufacturer with minimum of five years experience with successfully completed projects of a similar nature and scope.
 - 1. Installer's Field Supervisor: Experienced mechanic certified by metal panel manufacturer supervising work on site whenever work is underway.
- C. Steel Construction Publications: Comply with published recommendations in the following, unless more stringent requirements are indicated.
 - 1. American Institute of Steel Construction (AISC): "Steel Construction Manual."
 - 2. American Iron and Steel Institute (AISI): "Cold Formed Steel Design Manual."

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, metal panel installer, metal panel manufacturer's technical representative, inspection agency and related trade contractors.
 - 1. Coordinate building framing in relation to metal panel system.
 - 2. Coordinate openings and penetrations of metal panel system.
 - 3. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.6 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for specified products. Include data indicating compliance with performance requirements.
- B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.
 - 1. Indicate points of supporting structure that must coordinate with metal panel system installation.
 - 2. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.
- C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.
- D. Samples for Verification: Provide 12-inch long section of each metal panel profile. Provide color chip verifying color selection.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Indicating compliance of products with requirements.
- B. Qualification Information: For Installer firm and Installer's field supervisor.
- C. IAS Accreditation Certificate: Indicating that manufacturer is accredited under provisions of IAS AC472 Part B.
- D. Manufacturer's warranty: Unexecuted sample copy of manufacturer's warranty.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping.
 - 1. Deliver, unload, store, and erect metal panels and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
 - 2. Store in accordance with Manufacturer's written instruction. Provide wood collars for stacking and handling in the field.
 - 3. Shield foam insulated metal panels from direct sunlight until installation.

1.10 WARRANTY

- A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within one year from date of Substantial Completion.
- B. Special Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within the warranty period, as follows:
 - 1. Modified Silicone-Polyester Two-Coat System:
 - a. Basis of Design System: MBCI, Signature 200.
 - b. Color fading in excess of 7 Hunter units per ASTM D2244.
 - c. Chalking in excess of No. 6 rating per ASTM D4214.
 - d. Failure of adhesion, peeling, checking, or cracking.
 - e. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Manufacturer: **MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.**; Houston TX. Tel: (877)713-6224; Email: info@ecoficientseries.com; Web: www.mbcicom.com.
 - 1. Provide basis of design product, or comparable product approved by Architect prior to bid.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.
- B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E1592:
 - 1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
 - a. Wind Negative Pressure: Certify capacity of metal panels by actual testing of proposed assembly.
 - 2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/120 of the span with no evidence of failure.
 - 3. Seismic Performance: Comply with ASCE 7 Sections 9, "Earthquake Loads."
- C. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for

thermal stresses caused by temperature differences from one side of the panel to the other.

2.3 FORMED METAL SOFFIT AND LINER PANELS

- A. Flush-Profile, Concealed Fastener Metal Soffit and Liner Panels: Metal panels consisting of formed metal sheet with vertical panel edges, with flush joints between panels, field assembled with nested lapped edges, and attached to supports using concealed fasteners.
 - 1. Basis of Design: MBCI, Artisan Panel.
 - 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150), prepainted by the coil-coating process per ASTM A755/A755M.
 - a. Nominal Thickness: 24 gage coated thickness, with smooth surface.
 - 1) Exterior Finish: Modified silicone-polyester two-coat system.
 - 2) Color: As selected by Architect from manufacturer's standard colors.
 - 3) Panel Width: 12 inches.
 - 4) Panel Thickness: 1 inch.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide complete metal panel assemblies incorporating trim, fasciae, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.
- B. Flashing and Trim: Match material, thickness, and finish of metal panels.
- C. Fasteners: Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.

2.5 FABRICATION

- A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.
- B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.6 FINISHES

- A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- B. Modified Silicone-Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat meeting solar reflectance index requirements.
 - 1. Basis of Design: **MBCI, Signature 200.**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.
 - 1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.
- B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

3.2 METAL PANEL INSTALLATION

- A. Concealed-Fastener Formed Metal Soffit Panels: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, project drawings, and referenced publications. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.
- B. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer. Fasten panel to support structure through leading panel flange. Fit back flange of subsequent panel into secured flange of previous panel.
 - 1. Cut panels in field where required using manufacturer's recommended methods.
 - 2. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.
- C. Attach panel flashing trim pieces to supports using recommended fasteners.

3.3 ACCESSORY INSTALLATION

- A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel assembly, including trim, flashings, sealants, closure strips, and similar items.

2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.4 CLEANING AND PROTECTION

- A. Clean finished surfaces as recommended by metal panel manufacturer.
- B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 07 42 93 – SOFFIT PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Flush-profile, concealed fastener, lap-seam metal soffit and liner panels, with related metal trim and accessories.

1.2 RELATED REQUIREMENTS

- A. Division 05 Section "Structural Steel Framing" for steel framing supporting metal panels.
- B. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.
- C. Division 07 Section "Thermal Insulation" for thermal insulation installed under metal panels.
- D. Division 07 Section "Air Barriers" for air barriers within metal panel assembly and adjacent to metal panel assembly.
- E. Division 07 Section "Metal Roof Panels" for metal roof panels installed with metal soffit and liner panels.
- F. Division 07 Section "Metal Wall Panels" for metal wall panels installed with metal soffit and liner panels.
- G. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing items in addition to items specified in this Section.
- H. Division 13 Section "Metal Building Systems" for steel framing supporting metal panels.

1.3 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA): www.aamanet.org:
 - 1. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.
 - 2. AAMA 809.2 Voluntary Specification Non-Drying Sealants.
- B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International (ASTM): www.astm.org:
 - 1. ASTM A755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.

2. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
3. ASTM C920 - Specification for Elastomeric [Joint Sealants](#).
4. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
5. ASTM D4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
6. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

D. International Accreditation Service (IAS):

1. IAS AC472 Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems, Part B.

1.4 QUALITY ASSURANCE

- A. Manufacturer/Source: Provide metal panel assemblies and accessories from a single manufacturer accredited under IAS AC472, Part B.
- B. Installer Qualifications: Experienced Installer certified by metal panel manufacturer with minimum of five years experience with successfully completed projects of a similar nature and scope.
 1. Installer's Field Supervisor: Experienced mechanic certified by metal panel manufacturer supervising work on site whenever work is underway.
- C. Steel Construction Publications: Comply with published recommendations in the following, unless more stringent requirements are indicated.
 1. American Institute of Steel Construction (AISC): "Steel Construction Manual."
 2. American Iron and Steel Institute (AISI): "Cold Formed Steel Design Manual."

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, metal panel installer, metal panel manufacturer's technical representative, inspection agency and related trade contractors.
 1. Coordinate building framing in relation to metal panel system.
 2. Coordinate openings and penetrations of metal panel system.
 3. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.6 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for specified products. Include data indicating compliance with performance requirements.

- B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.
 - 1. Indicate points of supporting structure that must coordinate with metal panel system installation.
 - 2. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.
- C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.
- D. Samples for Verification: Provide **12-inch-long** section of each metal panel profile. Provide color chip verifying color selection.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Indicating compliance of products with requirements.
- B. Qualification Information: For Installer firm and Installer's field supervisor.
- C. IAS Accreditation Certificate: Indicating that manufacturer is accredited under provisions of IAS AC472 Part B.
- D. Manufacturer's warranty: Unexecuted sample copy of manufacturer's warranty.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping.
 - 1. Deliver, unload, store, and erect metal panels and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
 - 2. Store in accordance with Manufacturer's written instruction. Provide wood collars for stacking and handling in the field.
 - 3. Shield foam insulated metal panels from direct sunlight until installation.

1.10 WARRANTY

- A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within one year from date of Substantial Completion.
- B. Special Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within the warranty period, as follows:
 - 1. **Modified Silicone-Polyester Two-Coat System:**
 - a. Basis of Design System: **MBCI, Signature 200.**
 - b. Color fading in excess of 7 Hunter units per ASTM D2244.
 - c. Chalking in excess of No. 6 rating per ASTM D4214.
 - d. Failure of adhesion, peeling, checking, or cracking.
 - e. Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Manufacturer: **MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.**; Houston TX. Tel: (877)713-6224; Email: info@ecoficientseries.com; Web: www.mbc.com.
 - 1. Provide basis of design product, or comparable product approved by Architect prior to bid.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.
- B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E1592:
 - 1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
 - a. Wind Negative Pressure: Certify capacity of metal panels by actual testing of proposed assembly.
 - 2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/120 of the span with no evidence of failure.
 - 3. Seismic Performance: Comply with ASCE 7 Sections 9, "Earthquake Loads."

- C. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

2.3 FORMED METAL SOFFIT AND LINER PANELS

- A. Flush-Profile, Concealed Fastener Metal Soffit and Liner Panels: Metal panels consisting of formed metal sheet with vertical panel edges, with flush joints between panels, field assembled with nested lapped edges, and attached to supports using concealed fasteners.

1. Basis of Design: **MBCI, Artisan Panel.**
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, **Grade 50, Coating Class AZ50** (Grade 340, Coating Class AZM150), prepainted by the coil-coating process per ASTM A755/A755M.

- a. Nominal Thickness: **24 gage** coated thickness, with smooth surface.

- 1) Exterior Finish: Modified silicone-polyester two-coat system.
- 2) Color: As selected by Architect from manufacturer's standard colors.
- 3) Panel Width: **12 inches.**
- 4) Panel Thickness: **1 inch.**

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide complete metal panel assemblies incorporating trim, fasciae, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.
- B. Flashing and Trim: Match material, thickness, and finish of metal panels.
- C. Fasteners: Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.

2.5 FABRICATION

- A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.
- B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.6 FINISHES

- A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- B. Modified Silicone-Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat meeting solar reflectance index requirements.
 - 1. Basis of Design: **MBCI, Signature 200.**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.
 - 1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.
- B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

3.2 METAL PANEL INSTALLATION

- A. Concealed-Fastener Formed Metal Soffit Panels: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, project drawings, and referenced publications. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.
- B. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer. Fasten panel to support structure through leading panel flange. Fit back flange of subsequent panel into secured flange of previous panel.
 - 1. Cut panels in field where required using manufacturer's recommended methods.
 - 2. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.
- C. Attach panel flashing trim pieces to supports using recommended fasteners.

3.3 ACCESSORY INSTALLATION

- A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel assembly, including trim, flashings, sealants, closure strips, and similar items.

2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.4 CLEANING AND PROTECTION

- A. Clean finished surfaces as recommended by metal panel manufacturer.
- B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 07 52 00 - MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. Asphaltic modified bituminous roofing
 - 2. Insulation
- B. Related Sections
 - 1. Section 06100: Rough Carpentry
 - 2. Section 07620: Sheet Metal Flashing and Trim
 - 3. Section 15430: Plumbing Specialties

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM) - *Annual Book of ASTM Standards*
- B. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - *Architectural Sheet Metal Manual*
- C. Asphalt Roofing Manufacturers Association (ARMA)
- D. National Roofing Contractors Association (NRCA)
- E. American Society of Civil Engineers (ASCE)
- F. Factory Mutual (FM Global) - *Approval Guide*
- G. Underwriters Laboratories (UL) - *Roofing Systems and Materials Guide* (TGFU R1306)

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) *Roofing and Waterproofing Manual* for definitions of roofing terms related to this section.

1.4 PERFORMANCE REQUIREMENTS

- A. GAF shall provide all primary roofing materials that are physically and chemically compatible when installed in accordance with manufacturers current application requirements.

1.5 SUBMITTALS

- A. Product Data: Provide product data sheets for each type of product indicated in this section.
- B. Shop Drawings: Provide manufacturers standard details and approved shop drawings for the roof system specified.
- C. Samples: Provide samples of insulation(s), fasteners and roll goods for verification of quality.
- D. Certificates: Installer shall provide written documentation from the manufacturer of their authorization to install the roof system, and eligibility to obtain the warranty specified in this section.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: GAF shall provide a roofing system that meets or exceeds all criteria listed in this section.
- B. Installer's Qualifications:
 - 1. Installer shall be classified as a **GAF Certified™ Commercial Contractor** as defined and certified by GAF.
- C. Source Limitations: All components listed in this section shall be provided by a single manufacturer or approved by the primary roofing manufacturer.

1.7 PRE-INSTALLATION CONFERENCE

- A. Prior to scheduled commencement of the roofing installation and associated work, conduct a meeting at the project site with the installer, architect, owner, GAF representative and any other persons directly involved with the performance of the work. The installer shall record conference discussions to include decisions and agreements reached (or disagreements) and furnish copies of recorded discussions to each attending party. The main purpose of this meeting is to review foreseeable methods and procedures related to roofing work.

1.8 REGULATORY REQUIREMENTS

- A. All work shall be performed in a safe, professional manner, conforming to all federal, state and local codes.
- B. Exterior Fire Test Exposure: Provide a roofing system achieving a UL Class A rating for roof slopes indicated.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver all roofing materials to the site in original containers, with factory seals intact. All products are to carry either a GAF label.
- B. Store all pail goods in their original undamaged containers in a clean, dry location within their specified temperature range.
- C. Store roll goods on end on pallets in a clean, dry, protected area. Take care to prevent damage to roll ends or edges. Do not double stack modified bitumen products.
- D. Do not expose materials to moisture in any form before, during, or after delivery to the site. Reject delivery of materials that show evidence of contact with moisture.
- E. Remove manufacturer supplied plastic covers from materials provided with such. Use "breathable" type covers such as canvas tarpaulins to allow venting and protection from weather and moisture. Cover and protect materials at the end of each workday. Do not remove any protective tarpaulins until immediately before the material is to be installed.
- F. Materials shall be stored above 55°F (12.6°C) a minimum of 24 hours prior to application.

1.10 PROJECT CONDITIONS

- A. Weather
 - 1. Proceed with roofing only when existing and forecasted weather conditions permit.
 - 2. Ambient temperatures must be above 45°F (7.2°C) when applying hot asphalt or water based adhesives.

1.11 WARRANTY

- A. Provide RUBEROID®/GAFGLAS® Diamond Pledge™ ND L Roof Guarantee with edge to edge coverage and no monetary limitation, where the manufacturer agrees to repair or replace components in the roofing system, which cause a leak due to a failure in materials or workmanship.
 - 1. Duration: Twenty (20) years from the date of completion.
 - a. Materials and workmanship of listed products within this section are included when installed in accordance with current GAF application and specification requirements. Contact GAF Technical Support Services for the full terms and conditions of the guarantee.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. Acceptable Manufacturer: GAF, Commercial Roofing Products or equal.

2.2 ANCHOR SHEET

- A. Heavyweight asphalt coated glass fiber base sheet: Conforms to or exceeds requirements of ASTM D 4601, Type II, UL Type G2 BUR, and Federal Spec SS-R-620B Type II. Each roll contains three (3) squares (320 sq. ft.) of material, approximately 39.375" x 97.5' (1 m x 29.7 m); 68 lbs. (30.8 kg), **GAFGLAS® #75** base sheet.

2.3 BASE / PLY SHEETS

- A. Heavyweight asphalt coated glass fiber base sheet: Conforms to or exceeds requirements of ASTM D 4601, Type II, UL Type G2 BUR, and Federal Spec SS-R-620B Type II. Each roll contains three (3) squares (320 sq. ft.) of material, approximately 39.375" x 97.5' (1 m x 29.7 m); 68 lbs. (30.8 kg), **GAFGLAS® #75** base sheet.
- B. Strong, resilient, smooth surfaced asphalt modified bitumen membrane containing a core of non-woven polyester mat coated with flexible, SBS polymer-modified asphalt. Conforms to or exceeds requirements of ASTM D 6164 Type I Grade S. Each roll contains one and one-half squares of material, approximately 39.4" x 49.5' (1 m x 15.09 m), 89.5 lbs. (40.6 kg), **Ruberoid® Mop Smooth 1.5** base/ ply sheet.

2.4 MEMBRANE MATERIALS

- A. Cool Roof Rating Counsel listed, premium, fire resistant, coated granule surfaced modified bitumen sheet containing a core of non-woven polyester mat coated with flexible SBS polymer-modified asphalt. Conforms to or exceeds the requirements of ASTM D 6164 Type II Grade G. Each roll contains one square of material, approximately 39.625" x 32.56' (1 m x 9.92 m), 103.8 lbs. (47.04 kg), **Ruberoid® EnergyCap™ Mop Plus Granule FR** roof membrane.

2.5 FLASHING MATERIALS

- A. Heavyweight asphalt coated glass fiber base sheet: Conforms to or exceeds requirements of ASTM D 4601, Type II, UL Type G2 BUR, and Federal Spec SS-R-620B Type II. Each roll contains three (3) squares (320 sq. ft.) of material, approximately 39.375" x 97.5' (1 m x 29.7 m); 68 lbs. (30.8 kg), **GAFGLAS® #75** base sheet.
- B. Strong, resilient, smooth surfaced asphalt modified bitumen membrane containing a core of non-woven polyester mat coated with flexible, SBS polymer-modified asphalt. Conforms

to or exceeds requirements of ASTM D 6164 Type I Grade S. Each roll contains one and one-half squares of material, approximately 39.4' x 49.5' (1 m x 15.09 m), 89.5 lbs. (40.6 kg), **Ruberoid® Mop Smooth 1.5** base/ ply sheet.

- C. ENERGY STAR listed, premium, fire resistant, coated granule surfaced modified bitumen sheet containing a core of non-woven polyester mat coated with flexible SBS polymer-modified asphalt. Conforms to or exceeds the requirements of ASTM D 6164 Type II Grade G. Each roll contains one square of material, approximately 39.625' x 32.56' (1 m x 9.92 m), 103.8 lbs. (47.04 kg), **Ruberoid® EnergyCap™ Mop Plus Granule FR** roof membrane.

2.6 BITUMEN / ADHESIVES

- A. Asphalt Bitumen: ASTM D 312 Type III or IV
- B. SBS Adhesive: ASTM D 4586, **Matrix™ 102 SBS Membrane Adhesive**, by GAF.
- C. SBS Cement: ASTM D 4586, **Matrix™ 202 SBS Flashing Cement**, by GAF.
- D. Asphalt Primer: ASTM D 41 **Matrix™ 307 Premium Asphalt Primer**, by GAF.

2.7 ACCESSORIES

- A. Nails & Spikes
 - 1. **Cap head nail:** 1" (25 mm) diameter round or square cap, ring shank, or annular threaded. Roofing nail 3/8" (10 mm) diameter head/11-gauge, ring shank, or annular threaded; must be driven through minimum 1" (25 mm) round/square cap plate.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

- A. Obtain verification that the building structure can accommodate the added weight of the new roofing system.
- B. Confirm the adequacy of the new roofing system to provide positive slope to drain. Eliminate ponding areas by the addition of drainage locations or by providing additional pitch to the roof surface.
- C. Prepare substrate surfaces thoroughly prior to application of new roofing materials. This is particularly important for re-cover and reroofing applications. Providing a smooth, even, sound, clean, and dry substrate minimizes the likelihood that underlying deficiencies will cause premature deterioration or even failure of the new roofing system.
- D. All defects in the roof deck or substrate must be corrected by the responsible parties before new roofing work commences. Verify that the deck surface is dry, sound, clean, and smooth, and free of depressions, waves, or projections.
- E. Protect building surfaces against damage and contamination from roofing work.
- F. Where work must continue over completed roof areas, protect the finished roofing system from damage.
- G. Verify that the surfaces and site conditions are ready to receive work.
- H. Verify that the deck is supported and secured.

- I. Verify that the deck surfaces are dry and free of ice or snow.
- J. Verify that all roof openings, curbs, pipes, sleeves, ducts, vents, or other penetrations through the roof are solidly set, and that all flashings are tapered.

3.2 SUBSTRATE PREPARATION

A. General:

- 1. Prepare substrate surfaces thoroughly prior to application of new roofing materials. This is particularly important for re-cover and reroofing applications. Providing a smooth, even, sound, clean, and dry substrate minimizes the likelihood that underlying deficiencies will cause premature deterioration or even failure of the new roofing system.
- 2. The surface of the deck must be dry, firm, smooth, and free of dirt and loose material. Electrical conduits, bolts, and other small items must be removed from the surface of the roof deck; such surface irregularities cannot be properly insulated and roofed. It is the responsibility of the roofing contractor, deck contractor, or owner's representative to determine the suitability of the roof deck surface to receive the roof assembly. The deck must meet GAF requirements as described in the Roof Design section of the current GAF Application and Specifications Manual. None of the foregoing factors are the responsibility of GAF which under no circumstances will assume such responsibility.
- 3. Perimeter and penetration wood nailers and curbs must be in place as specified.
- 4. The roof deck must provide positive drainage or tapered insulation must be used to provide slope.
- 5. Outlets must be placed and installed to remove water promptly and completely from the roof.
- 6. Expansion joints, roof vents, roof drains, etc., must be installed using acceptable industry standards and GAF specifications and flashing details.

B. Tear-off

- 1. All old roofing must be removed down to the deck. The deck shall be cleaned, repaired, and otherwise conditioned to conform to the requirements of a new deck.
- 2. All old flashing must be removed and stripped from walls, curbs, etc.
- 3. All existing composition and metal flashing must be removed and replaced.
- 4. All existing metal counterflashing, metal coping, and other metal work above the roof system must be inspected and replaced or repaired as necessary to provide a watertight assembly.
- 5. All metal flashing must be primed with Matrix™ 307 Premium Asphalt Primer where it will come in contact with the GAF membrane.
- 6. Prime all masonry, metal, and existing asphalt surfaces and substrates with Matrix™ 307 Premium Asphalt Primer where GAF membranes are to be adhered.
- 7. Inspect roof drains and outlets. Remove existing drain flashings and replace broken or stripped bolts, clamping rings, and strainers. Drains must be M-Weld™ drains or drains with metal-type clamping rings. Plastic drains are not acceptable. All drains, including retro fit or insert drains, must be sumped to promptly remove water from the roof surface and meet code requirements.

8. **Note: Substrates must be inspected and accepted by the deck contractor, roof contractor, or owner as being ready to receive and hold the roof system as specified.**

C. Plywood Deck

1. Plywood sheathing must be exterior grade, minimum 4 ply, and not less than 15/32" (12 mm) ***Dade county*** 19/32" (15 mm) thick.
2. Preservatives or fire retardants used to treat the decking must be compatible with roofing materials.
3. The deck must be installed over joists that are spaced 24" (61 cm) o.c. or less.
4. The deck must be installed so that all four sides of each panel bear on and are secured to joist and cross blocking. "H" clips are not acceptable.
5. Panels must be installed with a 1/8" to 1/4" (3mm – 6mm) gap between panels and must match vertically at joints to within (1/8" (3mm).
6. Decking should be kept dry and roofed promptly after installation.
7. Light metal wall ties or other structural metal exposed on top of the wood deck shall be covered with one ply of a heavy roofing sheet, such as Stratavent® Eliminator™ Nailable Base Sheet, extending 2"-6" (5.1 cm – 15.2 cm) beyond the metal in all directions. Nail in place before applying the base ply.
8. Tape and staple fastening systems may be used on wood decks when they comply with local building codes.
9. Attach an acceptable base sheet through flat metal caps or use nails with attached 1" (25 mm) square or round metal caps that have a minimum withdrawal resistance of 40 pounds each (178 N).

D. Oriented Strand Board (OSB) Deck

1. Oriented Strand Board must carry a Structural 1 rating if it is to be used as a decking material.
2. Preservatives or fire retardants used to treat decking must be compatible with roofing materials.
3. The deck must be installed over joists that are spaced 24" (61 cm) o.c. or less.
4. The deck must be installed so that all four sides of each panel bear on and are secured to joist and cross blocking; the APA/Engineered Wood Association (APA) recommendations. "H" clips are not acceptable.
5. Panels must be installed with a 1/8" to 1/4" (3mm – 6mm) gap between panels and must match vertically at joints to within (1/8" (3mm).
6. Decking should be kept dry and roofed promptly after installation.
7. When light metal wall ties or other structural metal are exposed on top of the wood deck, cover them with a heavy ply of a roofing sheet, such as Stratavent® Eliminator™ Nailable Base Sheet, extending 2"-6" (5.1 cm – 15.2 cm) beyond the metal in all directions. Nail in place before applying the base ply.
8. Tape and staple fastening systems may be used on wood decks when they comply with local building codes.
9. Attach an acceptable base sheet through flat metal caps or use nails with attached 1" (25 mm) square or round metal caps that have a minimum withdrawal resistance of 40 pounds each (178 N).

3.3 INSTALLATION

A. General:

1. Install GAF roofing system according to all current application requirements in addition to those listed in this section.
2. Substrates must be inspected and accepted by the contractor as suitable to receive and hold roof membrane materials.
3. Start the installation of all membrane plies at the low point or drains, so the flow of water is over or parallel to the ply laps, but never against the laps.
4. Chalk lines where necessary to ensure proper alignment and headlap widths of membrane plies.
5. Use half base sheet width as a starter strip in two-ply roof constructions.
6. Installation of all membrane plies, except those that are mechanically fastened, shall result in a visible, uniform flow-out of bitumen at side and end laps.
7. Ensure that all membrane plies lay flat and are uniformly secured to their substrate. Wrinkles, fishmouths, and similar defects must be removed and patched.
8. Extend all membrane plies to dimensions necessary to accommodate flashing conditions shown in the RUBEROID®/GAFGLAS® Roof Flashing Details Manual.
9. All lap edges for GAF cap membranes shall be rolled-in or walked-in immediately after installation. Additional care must be taken to ensure complete bonding at "T" laps. Lap edges on all membrane sheets should be inspected for full and uniform bonding to the underlying membrane sheet.
10. Stagger all adjacent end laps for all membrane plies a minimum of 18" (457 mm). Side laps shall not coincide with underlying plies in multiple layer applications.
11. Prime all masonry, metal, and existing asphalt surfaces and substrate with asphalt primer where insulation or GAF membranes are to be adhered. Matrix™ 307 Premium Asphalt Primer (ASTM D41) shall be applied at the rate of 1 gal/square (0.41 L/m²). Allow the primer adequate time to dry.
12. Brooming-in of glass felts is vital to minimize voids and ensure complete, uniform attachment.
13. Occasionally, a roll of felt or membrane will contain a splice that was fabricated as part of the manufacturing process. These splices are marked. Cut out all splices and treat as an end lap.
14. Back nailing of felts and cap sheets, and the use of ASTM D312 Type IV asphalt is required on slopes 1/2:12 or greater. Refer to "Steep- Slope Requirements" in the next section.

B. Phasing:

1. The term "phasing" refers to the practice of applying part of a total roof membrane at one time and allowing that part to remain exposed to the weather for a period of time before applying the remaining elements of the roof system. Membranes applied in this manner are subject to early deterioration.
2. Blisters, voids, membrane damage, and moisture infiltration are much more likely to occur in "phased" roof membranes.
3. GAF does not approve the practice of "phasing".
4. Whenever it is necessary to put a building "in the dry" quickly, a temporary roof covering is recommended; this temporary roof should be removed prior to installation of the roof system.

3.4 STEEP SLOPE REQUIREMENTS **optional**

A. General:

1. Slippage of roofing systems may occur on slopes of 1/2:12 or greater. Supplemental fastening is therefore required, and, for most systems, all base, ply, and cap sheets must be installed parallel with the slope (strapping method) in accordance with the Steep-Slope Membrane Application Table. If the roof slope is less than 1/2:12, supplemental fastening and membrane strapping is not required.
 2. Use wood nailers (insulation stops) at least 3 1/2" (89 mm) wide and equal in thickness to the insulation. Nailers must be mechanically fastened to the deck and installed at right angles to the direction of the slope.
 3. On ridges where insulation stops are required, wood nailers must be a minimum 3 1/2" (89 mm) wide and equal in thickness to the insulation. Nailers shall be secured mechanically to the deck on both sides of the ridge. Where nailers meet, bevel edges to form a flush surface for membrane application.
- B. Wood Nailers on Slopes of 1/2:12 but less than 2:12:
1. For slopes 1/2:12 but less than 2:12, install wood nailers at the eave, at the ridge, and at intermediate points of no more than 16' (4.9 m) as outlined under the Steep-Slope Membrane Application Table. All dimensions are from inside face to inside face of the wood nailers. Ensure a snug fit with the courses of insulation, but where possible, avoid cutting the insulation.
 2. For non-insulated, nailable decks, back-nail the leading edge of the base plies directly to the deck at intervals not to exceed 16' (4.9 m). All fasteners should be covered by following courses.
 3. For non-insulated, non-nailable decks, set the wood nailers flush with decks and back-nail plies at intervals not to exceed 16' (4.9 m). All fasteners should be covered by following courses.
- C. Wood Nailers on Slopes of 2:12 but less than 3:12:
1. For slopes 2:12 to 3:12, install wood nailers at the eave, at the ridge, and at intermediate spacing of no more than 8' (2.4 m) as outlined under the Steep-Slope Membrane Application Table. All dimensions are from inside face to inside face of the wood nailers.
 2. Ensure a snug fit with the courses of insulation but avoid cutting the insulation where possible.
 3. For non-insulated, nailable decks, back-nail the plies directly to the deck at intervals not to exceed 8' (2.4 m). All fasteners should be covered by following courses.
 4. For non-insulated, non-nailable decks, set the wood nailers flush with decks and install at intervals not to exceed 8' (2.4 m). All fasteners should be covered by following courses.
- D. Wood Nailers on Slopes Greater than 3:12:
1. For roofs with slopes greater than 3:12, contact GAF Technical Support Services at 1-800-766-3411.
- E. Insulation Installation:
1. If insulation is to be installed, place insulation between wood nailers and mechanically attach, set in a GAF insulation adhesive, or set in hot asphalt.

F. Membrane Installation:

1. Steep-slope applications require installation of all base and ply sheets parallel to slope (Strapping Method) as required in the Steep-Slope Membrane Layout table. Back-nail each course into wood nailers or nailable decks approximately 1" (25 mm) from the leading edge of the sheets at recommended intervals. All end laps must be at wood nailers and blind-nailed into the wood nailer on 8" (203 mm) centers. Use nails with integral metal heads at least 1" (25 mm) round or square. For non-insulated, nailable decks, back-nail the leading edge of each course as described above directly into the deck at recommended intervals.
2. At ridges, base plies must extend across opposite sides of ridge over the nailer and be fastened on 8" (203 mm) centers. Use nails with integral metal heads at least 1" (25 mm) round or square. An additional layer of base sheet shall be centered over the ridge overlapping the fasteners at least 6" (152 mm).
3. After completion and fastening of base plies, install GAFGLAS® cap sheets or RUBEROID® membranes parallel to slope (Strapping Method) as required in the Steep-Slope Membrane Layout table. Terminate GAFGLAS® cap sheets or RUBEROID® membranes at wood nailers and fasten the top edge of each sheet with screws and 3" (76 mm) plates on 8" (203 mm) centers across the top of the sheet. The overlapping sheet must extend at least 9" (229 mm) past the top of the underlying sheet. All end laps must be staggered to the closest wood nailer, spaced a minimum of 4' (1.2 m). On slopes of 2:12 to 3:12, the GAFGLAS® cap sheets or RUBEROID® membranes must be cut into lengths not to exceed 17' (5.2 m). For non-insulated wood decks, terminate and fasten the end of the GAFGLAS® cap sheets or RUBEROID® membranes to the deck with the same fasteners, on the same spacing indicated above.
4. At ridges, cap sheets or RUBEROID® membranes must extend across opposite sides of the ridge over the nailer and be fastened with screws and 3" (76 mm) plates on 8" (203 mm) centers. An additional full-width ply of cap sheet or RUBEROID® membrane must be centered over the ridge to form a ridge cap, overlapping the fasteners at least 6" (152 mm).

3.5 BITUMEN

- A. Do not mix different types of asphalt.
- B. Use only ASTM D 312, Type III or Type IV Steep Asphalt. **Type III asphalt may be used on slopes up to 1/2" per foot (4cm/m). Type IV asphalt must be used on all slopes greater than 1/2" per foot (4 cm/m).**
- C. Application with hot asphalt requires continuous, uniform interply mopping rates of 25 lbs. +/- 20% per 100 square feet of roof area (1.2 kg/m²).
- D. Application temperature of the asphalt must be at the Equiviscous Temperature (EVT) with a tolerance of +/- 25°F (13.9°C), at which a viscosity of 125 centipoise is attained. When using mechanical asphalt applicators, the target viscosity should be 75 centipoise.
- E. For all SBS modified asphalt flashings; the minimum application temperature of the asphalt must be at the EVT or 425°F (218°C), whichever is greater, with a rolling bank (puddle) of mopping asphalt across the full width of the roll.
- F. Do not heat the asphalt to or above its flash point or hold the asphalt at temperatures above the finished blowing temperature for more than 4 hours.

- G. Do not keep heated tankers above 325°F (163°C) overnight.

3.6 BASE SHEET***MECHANICALLY ATTACHED***

- A. Roll the base sheet out over the deck insulation and allow it to relax. Lap the base sheet so the flow of water is over or parallel to, but never against the laps.
- B. Lap the base sheet 2" (5.1 cm), and 4" (10.2 cm) on the ends. Keeping the base sheet taut, push out all wrinkles and buckles ahead as fastening proceeds.
- C. Turn base sheet up to the top of the cant.
- D. Stagger adjacent end laps a minimum of 18" (45.7 cm).
- E. (Option 1)Fasten base sheet per code requirements.
- F. (Option 2 standard pattern-no insulation)Lap the base sheet 2" (51 mm), and mechanically fasten with three rows of fasteners. The first row (on the seam) will be 1" (25 mm) from the leading edge and on 9" (229 mm) centers. Locate the second row of fasteners 14" (356 mm) from the leading edge and on 18" (457 mm) centers. The third row of fasteners shall be 26" (660 mm) from the leading edge on 18" (457 mm) centers. The centers for the second and third rows should be staggered.
- G. (Option 3 standard pattern-sim attach with insulation)Lap the base sheet 2" (51 mm). Screws and plates are then installed in 3 staggered, equally spaced rows on 24" (610 mm) maximum centers in each row. One row is in the 2" (51 mm) side lap, the other rows are located equidistant from the lap rows approximately 12" - 13" (305 - 330 mm) from the lap rows. This pattern results in approximately one fastener per 2.1 square feet (0.20 m2). Along building perimeters (minimum 4 foot wide) (1.22 m) fastening pattern must be increased to one fastener per 1.2 square feet (0.11 m2), in 4 staggered, equally spaced rows of fasteners on 18" (457 mm) centers
- H. Refer to FMRC Approval Guide for FM Fastening patterns. Factory Mutual requires fastener density increases in perimeter and corner zones for FM 1-60 and FM 1-90 or greater. Refer to FM Loss Prevention Data Sheets 1-7, 1-28, 1-29 and 1-49.

Note: When fastening base sheets using screws and plates without insulation, the plate must be of a design that allows it to lie flat on the deck.

3.7 SBS BASE/PLY SHEET

- A. Install full width ply sheets, lapping 3" (7.62 cm) on the sides and 6" (15.2 cm) on ends. All end laps must be staggered a minimum of 18" (45.7 cm) so that no adjacent end laps coincide. If end laps fall in line or are not staggered the proper distance, a full width of Ruberoid® Mop SBS membrane must be installed over the end laps.
- B. For slopes less than 1/2" per foot (4.2 cm per meter), Type III or IV asphalt may be used. Type IV must be used on all slopes 1/2" per foot (4.2 cm per meter) and over. Asphalt shall be applied at its EVT temperature or 425°F (218°C), whichever is greater, in a uniform layer, without voids, at a rate of 25 lb./square (1.2 kg/m2) ±20%. See Article 3.04 "Bitumen". The mopping stroke will be such that the side lap is covered with asphalt last. A rolling bank (puddle) of mopping asphalt must be maintained across the full width of the roll.
- C. All laps must be parallel or perpendicular to the slope of the roof such that the flow of water is never against the lap.

- D. SBS membranes must not be applied during adverse weather or without precautionary measures in temperatures below 45°F (7.2°C). Contact GAF Contractor Services for details.
- E. Coiled rolls should be unrolled, placed upside down and allowed to “relax” prior to installation. Then re-roll to apply.
- F. Care should be taken to insure that the ply sheet lays flat in the asphalt. There must be complete adhesion between the ply sheet and the mopping asphalt. Brooming of the plies may be necessary under certain conditions to insure that the cap sheet adheres solidly to the asphalt. Apply extra pressure to avoid creating open channels, where three or more membranes are lapped.
- G. A minimum 3/8” (10 mm) asphalt flow-out must be obtained at all laps. Dry laps are not acceptable. Check all seams for full and uniform adhesion.

3.8 CAP SHEET***HOT CAP***

- A. Install full width cap sheets, lapping 3” (7.62 cm) on the sides and 6” (15.2 cm) on ends. All side and end laps must be staggered from underlying plies. All end laps must be staggered a minimum of 18” (45.7 cm) so that no adjacent end laps coincide. If end laps fall in line or are not staggered the proper distance, a full width of Ruberoid® Mop SBS membrane must be installed over the end laps.
- B. For slopes less than 1/2” per foot (4.2 cm per meter), Type III or IV asphalt may be used. Type IV must be used on all slopes 1/2” per foot (4.2 cm per meter) and over. Asphalt shall be applied at its EVT temperature or 425°F (218°C), whichever is greater, in a uniform layer, without voids, at a rate of 25 lb./square (1.2 kg/m²) ±20%. See Article 3.04 “Bitumen”. The mopping stroke will be such that the side lap is covered with asphalt last. A rolling bank (puddle) of mopping asphalt must be maintained across the full width of the roll.
- C. All laps must be parallel or perpendicular to the slope of the roof such that the flow of water is never against the lap.
- D. SBS membranes must not be applied during adverse weather or without precautionary measures in temperatures below 45°F (7.2°C). Contact GAF Contractor Services for details.
- E. Coiled rolls should be unrolled, placed upside down and allowed to “relax” prior to installation. Then re-roll to apply.
- F. Care should be taken to ensure that the cap sheet lays flat in the asphalt. There must be complete adhesion between the cap sheet and the mopping asphalt. Brooming of the plies may be necessary under certain conditions to ensure that the cap sheet adheres solidly to the asphalt. Apply extra pressure to avoid creating open channels, where three or more membranes are lapped.
- G. A minimum 3/8” (10 mm) asphalt flow-out must be obtained at all laps. Dry laps are not acceptable. Check all seams for full and uniform adhesion.

****For EnergyCap only****

- H. If damage by other trades or any inadvertent damage should occur to the EnergyCap™ product during installation, and for aesthetic purposes only, an additional fog coat of EnergyCote™ coating can be applied to the sheet at a rate of 1/2 to 1 gallon per 100 sq. ft.

3.9 PLY / CAP SHEET***HOT SBS PLIES & CAP***

- A. Install one ply of the specified Ruberoid® smooth sheet and follow with the specified granule surfaced sheet.
- B. Sheets shall be lapped 3” on the sides and all end laps must be staggered a minimum of 18” (45.7 cm) so that no adjacent end laps coincide. If end laps fall in line or are not staggered the proper distance, a full width of Ruberoid® SBS membrane must be installed over the end laps
- C. For slopes less than 1/2” per foot (4.2 cm per meter), Type III or IV asphalt may be used. Type IV must be used on all slopes 1/2” per foot (4.2 cm per meter) and over. Asphalt shall be applied at its EVT temperature or 425°F (218°C), whichever is greater, in a uniform layer, without voids, at a rate of 25 lb./square (1.2 kg/m²) ±20%. See Article 3.04 “Bitumen”. The mopping stroke will be such that the side lap is covered with asphalt last. A rolling bank (puddle) of mopping asphalt must be maintained across the full width of the roll.
- D. All laps must be parallel or perpendicular to the slope of the roof such that the flow of water is never against the lap.
- E. SBS membranes must not be applied during adverse weather or without precautionary measures in temperatures below 45°F (7.2°C). Contact GAF Contractor Services for details.
- F. Coiled rolls should be unrolled, placed upside down and allowed to “relax” prior to installation. Then re-roll to apply.
- G. Care should be taken to ensure that the cap sheet lays flat in the asphalt. There must be complete adhesion between the cap sheet and the mopping asphalt. Brooming of the plies may be necessary under certain conditions to ensure that the cap sheet adheres solidly to the asphalt. Apply extra pressure to avoid creating open channels, where three or more membranes are lapped.
- H. A minimum 3/8” (10 mm) asphalt flow-out must be obtained at all laps. Dry laps are not acceptable. Check all seams for full and uniform adhesion.
- I. Membranes must not be applied during adverse weather or without precautionary measures in temperatures below 45°F (7.2°C). Contact GAF Contractor Services for details.

****For EnergyCap only****

- J. If damage by other trades or any inadvertent damage should occur to the EnergyCap™ product during installation, and for aesthetic purposes only, an additional fog coat of EnergyCote™ coating can be applied to the sheet at a rate of 1/2 to 1 gallon per 100 sq. ft.

3.10 CAP SHEET***COLD APPLIED CAP SHEET ONLY***

- A. Install full width cap sheet, lapping 2” (5.1 cm) on the sides and 3” (7.62 cm) on the ends. Stagger adjacent end laps a minimum of 18” (45.7 cm) apart. Where installed over base sheet, stagger ply sheet’s side and end laps from underlying plies. If end laps fall in line or are not staggered the proper distance, a full width of Ruberoid® SBS membrane must be installed over the end laps.

- B. For slopes less than 1/2" per foot (4 cm per meter), membrane should be applied shingle fashion, perpendicular to the slope of the roof deck. On all slopes 1/2" per foot (4 cm per meter) and over, membrane should be installed parallel to the slope of the roof. In no case should the flow of water be against the laps.
- C. SBS membranes must not be applied during adverse weather or without precautionary measures in temperatures below 45°F (7.1°C). Contact GAF Contractor Services for details.
- D. The membrane material shall be unrolled, cut into 12'-18' (3.7-5.5 m) lengths, placed upside down and allowed to "relax" prior to installation. Then re-roll to apply.
- E. Starting at the low point or the drains, apply the Matrix™ cold adhesive to the substrate as follows:
 - 1. Pour the adhesive on the substrate and spread, using a serrated edged squeegee, applied at the rate of 1-1/2 gal per square (6 L/m²), or,
 - 2. Spray, using equipment that will apply the adhesive at a rate equal to 1-1/2 gal/square (6 L/m²).
- F. Apply the adhesive so that the substrate is coated in a pattern slightly larger than the first sheet being applied.
- G. End laps and selvage laps of the Ruberoid® being lapped must be coated with adhesive so that a visible bead of adhesive appears. Roll all laps with a steel roller to ensure proper adhesion. Alternately, the end laps and side laps may be hot-air welded. The hot-air welding method will provide a watertight lap immediately and may be preferable when inclement weather is threatening.
- H. Allow 5 to 15 minutes for solvents to evaporate from the adhesive (i.e. tack time or open time) before embedding any sheets into newly applied adhesive. Tack times may vary based on ambient conditions.
- I. Be careful to ensure that the Ruberoid® membrane lays flat in the cold adhesive. There must be complete adhesion between the cap sheet and the cold adhesive. Brooming of the plies may be necessary under certain conditions to assure that the cap sheet adheres solidly to the cold adhesive. Apply extra pressure to avoid creating open channels where three or more membranes are lapped.
- J. A minimum 3/8" (10 mm) and maximum 1" (2.5 cm) cold adhesive flow-out must be obtained at all seam areas when the side laps are not heat welded. Dry laps are not acceptable. Check all seams for full and uniform adhesion.
- K. Precautions:
 - 1. Certain Matrix Adhesives, Flashing Cements and Coatings are solvent based and do have an odor. These products will exhibit solvent odor during application and afterwards until fully cured and set up. Cure times can vary widely according to factors such as type of system installed, local weather and ambient temperatures. Precautions must be taken by the roofing contractor and project designer to minimize solvent odor penetration into occupied building spaces.
 - 2. Air intakes near the roof should be closed. Ductwork, equipment curbs, parapet walls, HVAC equipment and other deck penetrations or openings should be checked for entry sources and addressed to prevent possible odor infiltration.

3. On wood decks, a minimum 6-mil thick polyethylene sheet is required, installed directly on the deck to minimize potential odors entering the building during the roof installation and during the cure time. Air barriers should be considered for all porous deck types, terminated, and sealed to penetrations, walls, curbs, openings, and other roof terminations. (Caution: Polyethylene can be slippery. Until a base sheet can be securely nailed, or insulation can be mechanically attached, care must be taken when walking on the polyethylene to prevent slipping and falling.) Use of an air barrier may create a vapor retarder condition within the assembly and requires consideration of applicable dew point factors and thermal insulation requirements by the project designer.
4. Ruberoid cold process roof systems should not be used in situations where the underside of the roof deck is used as the top of a plenum of a HVAC system. This type of system is susceptible to solvent odor entry migrating through the deck and into the plenum space until the adhesives are fully cured.

3.11 PLY/ CAP SHEET***COLD PLIES & CAP***

- A. Install one ply of the specified Ruberoid® smooth sheet and follow with the specified granule surfaced sheet.
- B. Sheets shall be lapped 3" on the sides and all end laps must be staggered a minimum of 18" (45.7 cm) so that no adjacent end laps coincide. If end laps fall in line or are not staggered the proper distance, a full width of Ruberoid® SBS membrane must be installed over the end laps
- C. For slopes less than 1/2" per foot (4 cm per meter), membrane should be applied shingle fashion, perpendicular to the slope of the roof deck. On all slopes 1/2" per foot (4 cm per meter) and over, membrane should be installed parallel to the slope of the roof. In no case should the flow of water be against the laps.
- D. SBS membranes must not be applied during adverse weather or without precautionary measures in temperatures below 45°F (7.1°C). Contact GAF Contractor Services for details.
- E. The membrane material shall be unrolled, cut into 12'-18' (3.7-5.5 m) lengths, placed upside down and allowed to "relax" prior to installation. Then re-roll to apply.
- F. Starting at the low point or the drains, apply the Matrix™ cold adhesive to the substrate as follows:
 1. Pour the adhesive on the substrate and spread, using a serrated edged squeegee, applied at the rate of 1-1/2 gal per square (6 L/m²), or,
 2. Spray, using equipment that will apply the adhesive at a rate equal to 1-1/2 gal/square (6 L/m²).
- G. Apply the adhesive so that the substrate is coated in a pattern slightly larger than the first sheet being applied.
- H. End laps and selvage laps of the Ruberoid® being lapped must be coated with adhesive so that a visible bead of adhesive appears. Roll all laps with a steel roller to ensure proper adhesion. Alternately, the end laps and side laps may be hot-air welded. The hot-air welding method will provide a watertight lap immediately and may be preferable when inclement weather is threatening.

- I. Allow 5 to 15 minutes for solvents to evaporate from the adhesive (i.e. tack time or open time) before embedding any sheets into newly applied adhesive. Tack times may vary based on ambient conditions.
- J. Be careful to ensure that the Ruberoid® membrane lays flat in the cold adhesive. There must be complete adhesion between the cap sheet and the cold adhesive. Brooming of the plies may be necessary under certain conditions to assure that the cap sheet adheres solidly to the cold adhesive. Apply extra pressure to avoid creating open channels where three or more membranes are lapped.
- K. A minimum 3/8" (10 mm) and maximum 1" (2.5 cm) cold adhesive flow-out must be obtained at all seam areas when the side laps are not heat welded. Dry laps are not acceptable. Check all seams for full and uniform adhesion.
- L. Precautions:
 - 1. Certain Matrix Adhesives, Flashing Cements and Coatings are solvent based and do have an odor. These products will exhibit solvent odor during application and afterwards until fully cured and set up. Cure times can vary widely according to factors such as type of system installed, local weather and ambient temperatures. Precautions must be taken by the roofing contractor and project designer to minimize solvent odor penetration into occupied building spaces.
 - 2. Air intakes near the roof should be closed. Ductwork, equipment curbs, parapet walls, HVAC equipment and other deck penetrations or openings should be checked for entry sources and addressed to prevent possible odor infiltration.
 - 3. On wood decks, a minimum 6-mil thick polyethylene sheet is required, installed directly on the deck to minimize potential odors entering the building during the roof installation and during the cure time. Air barriers should be considered for all porous deck types, terminated, and sealed to penetrations, walls, curbs, openings, and other roof terminations. (Caution: Polyethylene can be slippery. Until a base sheet can be securely nailed, or insulation can be mechanically attached, care must be taken when walking on the polyethylene to prevent slipping and falling.) Use of an air barrier may create a vapor retarder condition within the assembly and requires consideration of applicable dew point factors and thermal insulation requirements by the project designer.
 - 4. Ruberoid cold process roof systems should not be used in situations where the underside of the roof deck is used as the top of a plenum of a HVAC system. This type of system is susceptible to solvent odor entry migrating through the deck and into the plenum space until the adhesives are fully cured.

3.12 BITUMINOUS BASE FLASHINGS***Hot Asphalt (Option 1)***

- A. Install GAF base flashing over all cant strips, horizontal to vertical transitions, roof edges and roof penetrations. Flashings are to be secured in accordance with current GAF application guidelines.
- B. Nailable curbs and walls must be covered with a layer of approved GAFGLAS® Base Sheet or backer ply fastened 8" (20.3 cm) o.c. in all directions with approved fasteners. All vertical laps shall be 4" (10.2 cm). Base sheet or backer ply must extend out onto the field of the roof as shown in the applicable GAF construction detail.
- C. Prime all metal and masonry surfaces with asphalt primer and allow adequate drying time prior to adhering flashing plies.

- D. Backer plies installed over masonry or other non-nailable substrates must be cut into manageable lengths to ensure adequate adhesion to the cant strip and vertical surfaces without excessive voids. All vertical laps shall be 4" (10.2 cm). Backer plies shall extend onto the field of the roof as shown in the applicable GAF construction detail.
- E. The finished ply of base flashing shall be run vertically to provide a selvage edge that will aid in achieving proper adhesion at the 3" (7.6 cm) vertical laps. If the sheet is run horizontally, the vertical laps must be a minimum of 6" (15.2 cm) and the selvage edge must be removed from the sheet or fully covered by the counterflashing. The finished flashing ply must extend out onto the field of the roof as shown in the applicable GAF construction detail and must be extended a minimum of 4" (10.2 cm) beyond the edge of the prior flashing plies. The flashing must be soundly adhered to the parapet, cant area and roof surface to result in a minimum void, non-bridging construction.
- F. Base flashing heights must be a minimum of 8" (20.3 cm) and a maximum of 24" (61.0 cm) above the roofline.
- G. Use only Type IV hot asphalt. Maintain asphalt at the Equiviscous Temperature (EVT) $\pm 25^{\circ}\text{F}$ (13.9°C) for all base and ply sheets used in flashing details. Apply flashing membranes at the EVT temperature or 425°F (218°C) whichever is greater. Firmly press sheets into the adhesive, and immediately nail the top of the flashing as specified in the appropriate flashing detail.
- H. Corner membrane flashings, such as "bow ties" for outside corners and "footballs" for inside corners or other membrane reinforcements are required to ensure that base flashing corners are sealed at cant areas. An alternate method of corner reinforcing is to install a smooth MB membrane reinforcement piece on the prepared corner substrate prior to final surfacing membrane. Refer to MB Flashing Details section of the GAF *Application and Specifications Manual*.

3.13 BITUMINOUS BASE FLASHINGS***Cold Adhesive (Option 2)***

- A. Install GAF base flashing over all cant strips, horizontal to vertical transitions, roof edges and roof penetrations. Flashings are to be secured in accordance with current GAF application guidelines.
- B. Nailable curbs and walls must be covered with a layer of approved GAFGLAS® or Ruberoid® Base Sheet or backer ply fastened 8" (20.3 cm) o.c. in all directions with approved fasteners. All vertical laps must be 4" (10.2 cm). Base sheet or backer ply must extend out onto the field of the roof as shown in the applicable GAF construction detail.
- C. Prime all metal and masonry surfaces with asphalt primer and allow adequate drying time prior to adhering flashing plies.
- D. Backer plies installed over masonry or other non-nailable substrates must be cut into manageable lengths to ensure adequate adhesion to the cant strip and vertical surfaces without excessive voids. All vertical laps shall be 4" (10.2 cm). Backer plies shall extend onto the field of the roof as shown in the applicable GAF construction detail.
- E. The finished ply of base flashing shall be run vertically to provide a selvage edge that will aid in achieving proper adhesion at the 3" (7.6 cm) vertical laps. If the sheet is run horizontally, the vertical laps must be a minimum of 6" (15.2 cm) and the selvage edge must be removed from the sheet or fully covered by the counterflashing. The finished flashing ply must extend out onto the field of the roof as shown in the applicable GAF construction detail and must be extended a minimum of 4" (10.2 cm) beyond the edge of

the prior flashing plies. The flashing must be soundly adhered to the parapet, cant area and roof surface to result in a minimum void, non-bridging construction.

- F. Base flashing heights must be a minimum of 8" (20.3 cm) and a maximum of 24" (61.0 cm) above the roofline.
- G. Use only trowel-grade modified adhesive. Apply using a trowel or wide-edged putty knife with a uniform 1/8" thickness throughout. Firmly press sheets into the adhesive, and immediately nail the top of the flashing as specified in the appropriate flashing detail.
- H. Corner membrane flashings, such as "bow ties" for outside corners and "footballs" for inside corners or other membrane reinforcements are required to ensure that base flashing corners are sealed at cant areas. An alternate method of corner reinforcing is to install a smooth MB membrane reinforcement piece on the prepared corner substrate prior to final surfacing membrane. Refer to MB Flashing Details section of the *GAF Application and Specifications Manual*.

3.14 SHEET METAL

- A. Metal should not be used as a component of base flashing. Because of the high coefficient of expansion of sheet metals and the large temperature changes that can be experienced on a roof, sheet metal or exposed metal components must be isolated from the waterproofing components of the roofing and flashing system as efficiently as possible to prevent the metal from splitting the membranes.
- B. All metal edge details scheduled to be included in the **Edge to Edge Coverage** of the Diamond Pledge™ Guarantee must be submitted and approved in writing by the manufacturer prior to project commencement.
- C. When it is unavoidable to use metal in the roofing system (i.e., lead flange at drains, gravel stops), treated wood nailers and insulation stops, 1" (25 mm) wider than the metal flange, should be provided for metal flange attachment. Metal flanges must always be set on top of the roof membrane with modified trowel grade cold adhesive applied material for SBS roof systems. The metal flange is then sealed using the applicable construction detail to meet applicable guarantee requirements. Metal accessories (gravel stops, counter flashing, etc.) should be 16 oz. (0.56 mm) copper, 24 gauge (0.71 mm) galvanized or stainless steel, 2 1/2 to 4 lb. (1.1-1.8 kg) lead, or 0.032" (0.81 mm) aluminum.
- D. Fabricate and install all sheet metal materials as shown in applicable construction details. Refer to SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.) for guidance on sheet metal treatments not addressed in this specification.
- E. Clean metal and apply asphalt primer to all sheet metal surfaces that will come into contact with asphalt or other bituminous materials; allow the primer adequate time to dry.
- F. Use fastener types compatible with the sheet metal type.
 - 1. Copper or lead-coated copper: use copper or bronze fasteners.
 - 2. Lead and galvanized steel: use galvanized or cadmium-plated sheet fasteners.
 - 3. Aluminum: use aluminum fasteners.
 - 4. Stainless steel: use stainless steel fasteners.
- G. Metal counterflashing shall have a minimum 4" (10.2 cm) face with a drip lip. The bottom edge of the counterflashing shall cover the roofing membrane and/or base flashing by a

minimum of 4" (10.2 cm). Metal counter flashing used for masonry walls, wooden walls, or through wall metal flashings should be a two piece design to allow for installation and later removal. Metal counter-flashings for stucco, EIFS, wood siding or similar materials should be designed appropriately, such as "Z" type flashing. End joints shall be lapped 3" (7.6 cm) or more. Adequate fasteners must be provided to secure against wind forces. Skirt fasteners shall be watertight.

- H. Metal termination bars shall be a minimum of 1/10" (3 mm) thick x 1" (25 mm) wide with preformed sealant edge lap. Bar should have 1/4" (6 mm) x 3/8" (10 mm) slotted holes on 4" (10.2 cm) centers to facilitate mechanical anchorage.

Note: Termination bars are not suitable in all base flashing and wall flashing conditions. Termination bars may only be used in conjunction with an appropriate counterflashing extending a minimum of 4" (10.2 cm) below the termination bar.

- I. Metal flanges for gravel stops, eave strips, and pitch pockets to be used in conjunction with roofing shall be primed (both sides), set in modified trowel grade cold adhesive applied material for SBS roof systems. Flanges shall be a minimum of 3 1/2" (8.9 cm) wide for gravel stops or eave strips and 4" (10.2 cm) wide for projections and extensions through the roof. The gravel stop lip should be at least 3/4" (19 mm) high. Eave strip lips shall be at least 3/8" (10 mm) high. Provisions must be made for securing the skirt to the face of the wall. This may be a wood nailer strip for masonry and metal construction. In all cases, gravel stop, and eave strip nailer should be fastened to the deck or deck system with adequate resistance against wind forces.
- J. Stacks shall have metal sleeve flashing a minimum of 8" (20.3 cm) high. Pitch pockets for brackets, supports, pad-eyes, etc., shall have a 4" (10.2 cm) minimum height metal sleeve.
- K. On re-roofing projects, provisions shall be made for reinstallation of existing sheet metal duct work, equipment, coping metal, and counterflashing removed in conjunction with the new work. Also, provide for cleaning and repairing of existing defective sheet metal, and replacement of missing and irreparable sheet metal to match existing types. Light gauge sheet metal flashings which are incorporated into the Ruberoid® roof system are not suitable for re-use and must be replaced with new material.
- L. Conduits and piping such as electrical and gas lines must be set on wood blocking or some other form of support. Wood blocking/supports must be set on pads constructed of an additional layer of roof membrane material.

3.15 ROOF PROTECTION

- A. Protect all partially and fully completed roofing work from other trades until completion.
- B. Whenever possible, stage materials in such a manner that foot traffic is minimized over completed roof areas.
- C. When it is not possible to stage materials away from locations where partial or complete installation has taken place, temporary walkways and platforms shall be installed in order to protect all completed roof areas from traffic and point loading during the application process.
- D. Temporary tie-ins shall be installed at the end of each workday and removed prior to commencement of work the following day.

3.16 CLEAN-UP

- A. All work areas are to be kept clean, clear, and free of debris at all times.
- B. Do not allow trash, waste, or debris to collect on the roof. These items shall be removed from the roof on a daily basis.
- C. All tools and unused materials must be collected at the end of each workday and stored properly off of the finished roof surface and protected from exposure to the elements.
- D. Dispose of or recycle all trash and excess material in a manner conforming to current EPA regulations and local laws.
- E. Properly clean the finished roof surface after completion, and make sure the drains and gutters are not clogged.
- F. Clean and restore all damaged surfaces to their original condition.

END OF SECTION

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sheet metal flashing and trim:
1. Formed roof drainage system.
 2. Formed low-slope roof flashing and trim where not part of Section 07 41 13.
 3. Formed wall flashing and trim (typical at perimeter of all wall openings).
 4. Self-adhering flexible membrane used in conjunction with sheet metal flashing where not part of Section 07 13 13 or 07 41 31.
- B. Related Sections include the following:
1. Division 5 Section "Metal Fabrication" for stainless steel components.
 2. Division 6 Section "Miscellaneous Carpentry" for wood nailers, curbs, and blocking.
 3. Division 7 Section "Metal Roof Panels" for metal roofing and flashing, trim and accessories, and Self-Adhering Sheet Waterproofing" for flexible flashing at wall openings.
 4. Division 9 Section "Portland Cement Plastering" for installing flashing and trim integral with plaster finish at wall openings.
 5. Division 22 Section "Plumbing" for roof drains & pipe fittings that attach to sheet metal gutters.

1.2 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing 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 sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.3 SUBMITTALS

- A. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
1. Identify material, thickness, weight, and finish for each item and location in Project.

2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.

1.4 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- B. Standard commercial items may be used for flashing, trim, reglets, and similar purposes provided such items meet or exceed the quality standards specified.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.6 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality, mill phosphatized for field painting.
- B. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

2.2 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.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads, suitable for galvanized steel, galvanized or cadmium plated.
 - 1. Nails for Stainless Steel Sheet: Series 300 stainless steel, 0.109 inch minimum and not less than 7/8 inch long, barbed with large head.
 - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 - 3. Blind Fasteners: Rivets High-strength aluminum, stainless-steel or as recommended for the particular use.
 - 4. Washers: As required, neoprene faced where water-tight condition is required.
 - 5. Bolts and Nuts: FF-B-578 C, FF-B-588C.
- C. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
- D. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.
- E. Burning Rod for Lead: Same composition as lead sheet.
- F. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape, suitable for high temperature conditions.
- G. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- J. Self-Adhering, Polyethylene-Faced Sheet: ASTM D 1970, 40 mils thick minimum, consisting of slip-resisting polyethylene-film reinforcing and top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied.
 - 1. Available Products:
 - a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; "CCW WIP 300HT."
 - b. Grace, W. R. & Co.; "Ultra."
 - c. Owens Corning; "WeatherLock."
 - d. Protecto Wrap Company; "Rainproof 40."
- K. Slip Sheet: Building paper, minimum 5 lb/100 sq. ft., rosin sized.
- L. Underlayment Felt: Asphalt saturated organic felt per CBC Standard 32-1, 15 lb. minimum.

2.3 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal,

and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

- B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 1. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.4 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate from materials as indicated by the drawings (match siding when exposed) to cross section indicated, complete with end pieces, outlet tubes, and other special pieces and accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness at a minimum of 36"o.c. or as indicated by the drawings and/or SMACNA. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.
 - 1. Gutter Style: As indicated by drawings.
 - 2. Expansion Joints: Butt type.
 - 3. Accessories: Stainless steel wire ball downspout strainer.
- B. Downspouts: Fabricate downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Manufactured Hanger Style: 1-35A for rectangular downspouts and I-35J for round downspouts.
 - 2. Provide sheet metal terminal head in shapes indicated or as approved by Architect.
 - 3. Coordinate with plumbing contractor for water-tight installation of horizontal and vertical roof drains in sheet gutters as indicated in drawings.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Base Flashing: Fabricate from the following material:

1. Galvanized Steel: 0.0276 inch, 22 gage, thick, unless indicated otherwise by drawings.
- B. Counterflashing: Fabricate from the following material:
 1. Galvanized Steel: 0.0217 inch, 24 gage, thick, unless indicated otherwise by drawings.
- C. Flashing Receivers: Fabricate from the following material:
 1. Galvanized Steel: 0.0217 inch, 24 gage, thick, unless indicated otherwise by drawings.
- D. Roof-Penetration Flashing: Fabricate from the following material:
 1. Lead: 4.0 lb/sq. ft., hard tempered.
- E. Openings Flashing in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high end dams. Fabricate from the following material:
 1. Galvanized Steel: 0.0217 inch, 24 gage, thick.
- F. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Furnish with 6-inch-wide joint cover plates.
 1. Joint Style: Butt, with 12-inch- wide concealed backup plate.
 - a. Stainless Steel: .031 inch, 22 gage, thick, unless indicated otherwise by drawings.
 - b. Galvanized Steel: 0.0396 inch, 24 gage thick, unless indicated otherwise by drawings.
- G. Copings/Parapet Caps: Fabricate in minimum 96-inch- long, but not exceeding 10-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, seal, and solder or weld watertight.
 1. Joint Style: Butt, with 12-inch-wide concealed backup plate.
 2. Fabricate copings from the following material:
 - a. Stainless Steel: .031 inch, 22 gage, thick, unless indicated otherwise by drawings.
 - b. Galvanized Steel: 0.0396 inch, 24 gage thick, unless indicated otherwise by drawings.

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 work.
 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 2. Verify compliance with requirements for installation tolerances of substrates.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Install underlayment as indicated on Drawings.
- B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- C. Self-Adhering membrane underlayment: Install similar to underlayment at parapet caps and all wall and roof openings including door, window, lower opening perimeters and other wall/roof penetrations to seal substrate from moisture and shed water.

3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Form sheet metal accurately and to the dimensions and shapes required, finishing molded and broken surfaces with true, sharp, and straight lines and angles and, where intercepting other members, coping to an accurate fit and soldering securely.
 - 2. Unless otherwise specifically permitted by the Architect, turn exposed edges back 1/2".
 - 3. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 1. Make lock seam work flat and true to line, sweating full of solder.
 - 2. Make lock seams and lap seams, when soldered, at least 1/2" wide.
 - 3. Where lap seams are not soldered, lap according to pitch, but in no case less than 3".
 - 4. Make flat and lap seams in the direction of flow.
- C. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- D. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- E. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
- F. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - 1. 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 underlayment.
 - 2. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

- G. 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 or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
1. Join parts with rivets or sheet metal screws where necessary for strength and stiffness.
 2. Provide suitable watertight expansion joints for runs of more than 40'-0", except where closer spacing is indicated on the Drawings or required for proper installation.
- H. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
1. Whenever possible, secure metal by means of clips or cleats, without nailing through the exterior metal.
 2. In general, space nails, rivets, and screws not more than 8" apart and, where exposed to the weather, use lead washers.
 3. For nailing into wood, use barbed roofing nails 1-1/4" long by 11 gage.
 4. For nailing into concrete, use drilled plugholes and plugs.
 5. Galvanized or Pre-painted, Metallic-Coated Steel: Use stainless-steel fasteners unless noted otherwise.
 6. Stainless Steel: Use stainless-steel fasteners.
- I. Seal joints with elastomeric sealant as required for watertight construction. Install sealant tape where indicated.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
- J. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except where pre-tinned surface would show in finished Work.
1. Perform soldering slowly, with a well heated copper, in order to heat the seams thoroughly and to completely fill them with solder.
 - a. Do not use open-flame torches for soldering.
 - b. Heat surfaces to receive solder and flow solder into joints.
 - c. Fill joints completely.
 - d. Completely remove flux and spatter from exposed surfaces.
 2. Perform soldering with a heavy soldering copper of blunt design, properly tinned for use.
 - a. Pre-tinning is not required for lead.
 3. Make exposed soldering on finished surfaces neat, full flowing, and smooth.
 4. After soldering, thoroughly wash acid flux with a soda solution.

3.4 ROOF FLASHING INSTALLATION (Where not included as part of Metal Panel Roofing System)

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 - 1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 16-inch centers.
- C. 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.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.
 - 1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.
 - 2.
- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
 - 1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
 - 2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.5 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Openings Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.6 MISCELLANEOUS PRODUCTS (if not detailed on the drawings)

- A. Sheet metal copings:
 - 1. Follow standards shown in SMACNA manual, CHAPTER 3
 - 2. Use 22 gage MIN. galvanized sheet metal, unless otherwise noted on the drawings.
 - 3. Slope surface toward roof side of wall with a minimum of 1/2":12" slope.
 - 4. Angle and return bottom edges for rigidity.
 - 5. Turn down a minimum of 4" at inside edges, or as otherwise detailed.
 - 6. Turn down outside a minimum of 4", or as otherwise indicated.

- B. Exposed platforms (if not detailed on the Drawings):
1. Provide a single piece of 20 gage galvanized sheet metal cover over roofing felts as detailed or specified in the roofing sections.
 - a. Cover shall turn down no less than 4" and have corners soldered;
 - b. Where seams are required, use single lock standing seam (SMACNA Figure 3-3) or flat lock seam (SMACNA Figure 3-2).
 - c. Attach cover to platform using wood screws with neoprene washers every 12" on centers on the vertical surface where required.
 - d. Do not penetrate membrane below horizontal metal cover.
- C. Pitch pans (if applicable):
1. Where unflashed projections extend through or rest upon the roof surface, and cannot be flashed with a prefabricated lead boot or SBS-modified bitumen, provide a primed pitch pan in accordance with SMACNA Manual, Plate 68, Figure E, with minimum 4" high collar and 6" flange, except where otherwise indicated.
 2. Pitch pan shall be spot welded and hot soldered to prevent bitumen loss.
 3. Set flange on last layer of SBS modified bitumen roofing membrane, and nail at 6" on centers.
 4. Cover flange with one layer of SBS-modified bitumen, extending onto roof 4", 8", and 12".
 5. Fill inside of pan with minimum 1-1/2" of modified elastomeric asphalt mastic over grout.
- D. Cold pipe flashing:
1. Provide 4 lb lead manufactured flashings in accordance with SMACNA , Figure 4-14b.
 2. Integrate flanges within roofing plies.
- E. Provide custom hooded flashings at all ganged vertical pipes/penetrations, using curbed type flashings in accordance with SMACNA Manual, Figure 4-14A.
- F. Surface mounted counterflashings:
1. At concrete or masonry walls, provide a two-piece surface-mounted counterflashing system of galvanized steel (Fry or approved equal).
 2. Seal receiver to wall surface with a thermoplastic rubber sealant approved in advance by the Architect.
 3. Fasten the receiver into the wall at 12" on centers; snap in the second piece after base flashing has been installed.
 4. At concrete masonry units, provide a thermoplastic rubber sealant approved in advance by the Architect.
- G. Scuppers at exterior walls (if not detailed on the drawings) SMACNA Figure 1-26:
1. Minimum exterior dimensions shall be 4" x 8".
 2. Do not damage structural elements.
 3. Provide new galvanized sheet metal scuppers with a minimum 6" wide flange.
 4. Weld and hotsolder in accordance with SMACNA chapter 1
 5. Prime and cover both sides of flange with bitumen.
 6. Integrate into roofing felts.
 7. Extend outlet a minimum of 2" beyond wall and form a drop at bottom edge.
 8. Caulk around at exterior of wall.
 9. Seal roofing into scuppers outlet bitumen.
 10. Provide leader boxes and downspouts where indicated.

11. Unless otherwise indicated, overflow scupper openings shall be 2" above main scupper opening through wall.

H. Drains: SMACNA Figure 1-37

1. Provide 4 lb lead drain pan in drains and overflows.
2. Do not cut lead to fit corners.
3. Install roof around the sump area as specified and cut roofing ply assembly flush with drain assembly at drain opening.
4. Provide asphalt primed lead flashing on top of roofing felts; size the lead flashing to extend uninterrupted up cants or tapered edge strips, and to terminate just below deck line.
5. Immediately install and tighten clamping ring into lead only, using caution not to break lead sheet.
6. Hand nail perimeter 4" on centers with one row of 1" head ringshanked nails.
7. Cover with roofing cap sheet.
8. All edges shall exhibit minimum 1/4" bead of asphalt.

3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 ROOF FLASHING INSTALLATIONS

- A. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 24-inch centers.
 2. interlock interior leg of coping with continuous cleats anchored at 24-inch centers.

3.9 MISCELLANEOUS FLASHING INSTALLATION

- A. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.

3.10 TESTS

- A. Upon request of the Architect, demonstrate by hose or standing water that the flashing and sheet metal are completely watertight.

3.11 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. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Throughout the Work, seal and caulk joints where shown on the Drawings and elsewhere as required to provide a positive barrier against passage of moisture, passage of air, and transmission of sound or noise.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, drawings and general provisions of Contract including General, Special and supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 2. Firestopping of floor, wall, and ceiling penetrations, and joint firestopping systems are specified in Sections 07 84 10 and 07 84 43.

1.2 SUBMITTALS

- A. Product data: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
 - 3. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
 - 4. Provide a letter from the manufacturer's representative stating that the proposed sealants are appropriate to the use and location in this project.
- B. Samples: Upon request of the Architect, submit Samples of each sealant, each backing material, each primer, and each bond breaker proposed to be used. Provide samples of all exposed to view sealants to Architect for color selection.

1.3 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not retain at the job site material which has exceeded the shelf life recommended by its manufacturer.

PART 2 - PRODUCTS

2.1 SEALANTS

- A. Provide the following noise, moisture & air penetration sealants, or equals approved in advance by the Architect, where called for on the Drawings or otherwise required for a complete and proper installation.
1. Horizontal Sealants
 - a. Self-leveling, complying with ASTM C920-79, grade P, class 25;
 - b. Acceptable products (or approved equal):
 - 1) "Vulkem 45, one-part;"
 - 2) Vulkem 245, two-part;"
 2. Vertical Sealants:
 - a. Non-sag, complying with ASTM C920-79, type S, grade NS, class 25, use NT, M, A, and O;
 - b. Acceptable products (or approved equal):
 - 1) Sonolastic NP-1 Chemrex Inc.
 - 2) Vulkem 116", one-part;
 - 3) "Vulkem 921", one-part;
 - 4) "Chem-Calk 100" Bostick Construction Products Div.
 - 5) "PRC RubberCalk 7000", one-part Product Research & Chemical Corp.
 - 6) GC-9 Synthacalk", Pecora Corp.
 3. Sealant Type D:
 - a. Silicone (vertical surfaces only), complying with Fed Spec TT-S-01543A, class A, low modulus;
 - b. Acceptable products (or approved equal):
 - 1) "Dow Corning 790 Sanitary Sealant;"
 4. Sealant Type E:
 - a. Acrylic latex, complying with ASTM C834-76;
 - b. Acceptable products (or approved equal):
 - 1) "Pecora AC 20";
 5. Acoustical Joint Sealants Type E:
 - a. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
 - b. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - c. Available Products:
 - 1) Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - 2) United States Gypsum Co.; SHEETROCK Acoustical Sealant.
 6. Acoustical Sealant for Concealed Joints : Manufacturer's standard, nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.
 - a. Available Products:
 - 1) Pecora Corporation; BA-98.
 - 2) Tremco; Tremco Acoustical Sealant.

7. Sealant Type F:
 - a. Acoustical sealant (interior concealed conditions only)
 - b. Acceptable products (or approved equal):
 - 1) Sheetrock Acoustical Sealant.
 8. Fire-stop Sealant complying with ASTM E84 and E814, UL 1479
 - a. Acceptable products (or approved equal): See Specification Section 07840.
- B. All sealants shall be reviewed and approved by the manufacturer as to the appropriateness of its application to the designated use. No sealant shall be selected or used for locations or conditions not in compliance with the manufacturer's recommendations.
- C. For other services, provide products especially formulated for the proposed use and approved in advance by the Architect.
- D. Colors:
 1. Colors for each sealant installation will be selected by the Architect from standard colors normally available from the specified manufacturer.
 2. Should such standard color not be available from an approved substitute manufacturer except at additional charge, provide such colors at no additional cost to the Owner.
 3. In concealed installations, and in partially or fully exposed installations where so approved by the Architect, use standard gray or black sealant.

2.2 PRIMERS

- A. Use only those primers which have been tested for durability on the surfaces to be sealed and are specifically recommended for this installation by the manufacturer of the sealant used.

2.3 BACKUP MATERIALS

- A. Use only those backup materials which are non-absorbent, non-staining, and specifically recommended for this installation by the manufacturer of the sealant used.

2.4 MASKING TAPE

- A. For masking around joints, provide an appropriate masking tape which will effectively prevent application of sealant on surfaces not scheduled to receive it, and which is removable without damage to substrate.

2.5 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Concrete and ceramic tile surfaces:
1. Install only on surfaces which are dry, sound, and well brushed, wiping free from dust.
 2. At open joints, remove dust by mechanically blown compressed air if so required.
 3. To remove oil and grease, use sandblasting or wire brushing.
 4. Where surfaces have been treated, remove the surface treatment by sandblasting or wire brushing.
 5. Remove laitance and mortar from joint cavities.
- B. Steel surfaces:
1. Steel surfaces in contact with sealant:
 - a. Sandblast as required to achieve acceptable surface for bond.
 - b. If sandblasting is not practical, or would damage adjacent finish, scrape the metal or wire brush to remove mill scale and rust.
 - c. Use solvent to remove oil and grease, wiping the surfaces with clean white rags only.
 2. Remove protective coatings on steel by sandblasting or by using a solvent which leaves no residue.
- C. Aluminum surfaces:
1. Aluminum surfaces in contact with sealant:
 - a. Remove temporary protective coatings, dirt, oil, and grease.
 - b. When masking tape is used for protective cover, remove the tape just prior to applying the sealant.
 2. Use only such solvents to remove protective coatings as are recommended for that purpose by the manufacturer of the aluminum work, and which are non-staining.

3.3 INSTALLATION OF BACKUP MATERIAL

- A. When using backup of tube or rod stock, avoid lengthwise stretching of the material. Do not twist or braid hose or rod backup stock.
- B. Installation tool:
1. For installation of backup material, provide a blunt surfaced tool of wood or plastic, having shoulders designed to ride on the adjacent finished surface and a protrusion of the required dimensions to assure uniform depth of backup material below the sealant.
 2. Do not, under any circumstance, use a screwdriver or similar tool for this purpose.
 3. Using the approved tool, smoothly and uniformly place the backup material to the depth indicated on the Drawings or otherwise required, compressing the backup material 25% to 50% and securing a positive fit.

3.4 PRIMING

- A. Use only the primer approved by the Architect for the particular installation, applying in strict accordance with the manufacturer's recommendations as approved by the Architect.

3.5 BOND-BREAKER INSTALLATION

- A. Provide an approved bond-breaker where recommended by the manufacturer of the sealant, and where directed by the Architect, adhering strictly to the manufacturers' installation recommendations.

3.6 INSTALLATION OF SEALANTS

- A. Prior to start of installation in each joint, verify the joint type according to details on the Drawings, or as otherwise directed by the Architect, and verify that the required proportion of width of joint to depth of joint has been secured.
- B. Equipment:
 - 1. Apply sealant under pressure with power-actuated hand gun or manually-operated hand gun, or by other appropriate means.
 - 2. Use guns with nozzle of proper size, and providing sufficient pressure to completely fill the joints as designed.
- C. Thoroughly and completely mask joints where the appearance of primer or sealant on adjacent surfaces would be objectionable.
- D. Install the sealant in strict accordance with the manufacturer's recommendations, thoroughly filling joints to the recommended depth. Sealant should be continuous without skips, gaps or voids.
- E. Tool joints to the profile shown on the Drawings, or as otherwise required if such profiles are not shown on the Drawings.
 - 1. Provide uniformly smooth joints with slightly concave surface.
 - 2. Do not use tooling agent unless specifically so recommended in writing by the manufacturer of the sealant.
- F. Sealants that, in the opinion of the Architect, are not properly installed according to the manufacturer's recommendations shall be totally removed. The joint shall be thoroughly cleaned, taking care to protect adjacent surfaces. New sealant shall be installed in accordance with these specifications and manufacturer's recommendations.
- G. Cleaning up:
 - 1. Remove masking tape immediately after joints have been tooled.
 - 2. Clean adjacent surfaces free from sealant as the installation progresses, using solvent or cleaning agent recommended by the manufacturer of the sealant used.
 - 3. Upon completion of the work of this Section, promptly remove from the job site all debris, empty containers, and surplus material derived from this portion of the Work.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS, WINDOWS, AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Standard hollow metal doors and frames for doors and windows.
- B. Related Sections
 - 1. Division 1 Section "Submittal Procedures" for shop drawing, product data and sample submittals.
 - 2. Division 8 Sections "Prefinished Wood Doors" for doors installed in hollow metal frames and "Glazing" for glass lite in hollow metal frames and doors.
 - 3. Division 8 Section "Door Hardware" for door hardware for hollow metal doors and/or frames.
 - 4. Division 9 Sections "Painting" for field painting hollow metal doors and frames.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated within 30 days of issuance or Notice to Proceed. Include construction details, material descriptions, core descriptions, and finishes.
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 3. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door design.
 - 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.
 - 5. Locations of reinforcement and preparations for hardware.
 - 6. Details of each different wall opening condition.
 - 7. Details of anchorages.
 - 8. Details of accessories.
- C. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

D. Coordination with other trades:

1. Submittals shall flag areas of coordination with other trades or where materials that interface with materials specified herein are necessary. Indicate coordination of glazing frames and stops with glazing requirements; indicate coordination with finish hardware.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
- B. Fire-Rated Door Assemblies: Assemblies complying with CBC Section 715.4 and NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to UL 10B or UL 10C. Label all such doors and frames accordingly.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.
 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Ceco Door Products; an Assa Abloy Group company.
2. Curries Company; an Assa Abloy Group company.
3. Fleming Door Products Ltd.; an Assa Abloy Group company.
4. Steelcraft; an Ingersoll-Rand company.
5. Republic Builders Products.
6. Security Metal Products; an Assa Abloy Group company.

B. Grout: USG

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized, 18 gage minimum.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- H. Glazing: Comply with requirements in Division 8 Section "Glazing".
- I. Shop Applied Primer For Ferrous Metals: Manufacturer or fabricator's standard, fast-curing, lead free, "universal" primer; selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated. Provide shop primer paint material that is compatible with finish paint systems indicated and is in compliance with the current EPA rules and regulations at the time and place of application.

2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 1. Design: Flush panel.

2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
 - a. Fire Door Core: As required to provide fire-protection ratings indicated.
 3. Vertical Edges for Single-Acting Doors: Beveled edge.
 - a. Beveled Edge: 1/8 inch in 2 inches.
 4. Top and Bottom Edges: Closed with flush 0.042-inch- thick, end closures or channels of same material as face sheets.
 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless). 16 gage faces.
 2. Exterior doors to be galvanized complying with ASTM A 525 (A60). Wipe coat galvanizing is not permitted.
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless). 16 gage faces.
 2. Classroom doors shall have a foam core capable of providing a minimum STC 39 rating for the door.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered corners.
 2. Fabricate frames as face welded unless otherwise indicated.
 3. Frames for Level 3 Steel Doors: 0.067-inch (14 gage) thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet.
1. Fabricate frames with mitered corners.
 2. Fabricate frames as face welded unless otherwise indicated.
 3. Frames for level 3 steel doors 0.053 inch (16 gage) thick sheet steel.
 4. Frames for Wood Doors: 0.053-inch (16 gage) thick steel sheet.
 5. Frames for borrowed lights: 0.053 inch (16 gage) thick sheet steel.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 2. Post installed Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.042 (18 gage) inch thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.042 (18 gage) inch thick, fabricated from same material as frames in which they are installed.

2.7 LOUVERS

- A. Provide louvers for exterior and interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of minimum 0.020-inch thick, (24 gage) cold-rolled steel sheet set into 0.032-inch thick steel frame. Factory primed, rated when indicated by drawings. See mechanical drawings for size requirements.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
 - 2. Fusible link type where indicated to be part of a rated assembly, minimum 14 gage construction.
 - 3. Unless noted otherwise, all exterior louvered openings shall be screened.

2.8 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

2. Glazed Lites: Factory cut openings in doors.
 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush all joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Side Light 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 butt welding.
 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
 - b. Anchor Fasteners: #8 x 1/2" zinc coated self tapping hex washer head screws, provide two per strap.
 6. Door Silencers: Except on gasketed doors, 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 silences.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
 - c. Do not provide holes or silencers at openings receiving weatherstripping.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame molding on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.9 ACCESSORIES

- A, Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

2.10 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
 2. Clean, treat, and paint (primer) exposed surfaces of steel door and frame units, including galvanized surfaces.
 3. Clean steel surfaces of mill scale, rust, oil, grease dirt, and other foreign materials before the application of paint.
 4. Apply shop primer evenly to provide uniformly finished surfaces ready for finish painting.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- D. 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.
- E. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- F. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install frames with removable glazing stops located on secure side of opening.
 - c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - d. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout. Anchor type shall not obstruct filling the frame with grout.
 5. When detailed for installation in prepared openings in concrete construction (dimpled frames), provide sealant between frame and concrete in accordance with provisions of "Joint Sealers" Section of these Specifications.
 6. Windows shall have strap anchors within 12" of each corner and at 24" o.c. max. Fasten to framing with 8 d nails.
 7. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, 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.

- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within specified below. Shim as necessary. Comply with SDI-100.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jamb and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire Rated Doors: Install doors with clearances according to NFPA 80.
- D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.
 - 1. Secure stops 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.

3.4 ADJUSTING AND CLEANING

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

END OF SECTION 081113

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Access doors and frames for walls, ceilings and plaster soffits.
- B. Related Sections include the following:
 - 1. Division 8 Section "Door Hardware" for mortise lock cylinders.
 - 2. Division 9 Sections for gypsum board and plaster assemblies. Division 9 Sections for special requirements related to special finishes.
 - 3. Plumbing, mechanical, electrical, and low voltage drawings and specifications for doors provided by respective disciplines.

1.2 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, hardware, and attachments to other work.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain access door(s) and frame(s) through one source from a single manufacturer.
- B. Size Variations: Obtain Architect's acceptance and approval of manufacturer's standard size units that may vary slightly from sizes indicated on Drawings

1.4 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to attic spaces, concealed plumbing, mechanical, electrical, fire alarm, fire sprinklers or other concealed work.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.

2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Steel Sheet: Uncoated or electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
 - C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.
 - D. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. 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."
 2. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
 - a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
 - E. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.
 - F. Plaster Beads: Edge trim formed from 22 gauge galvanized perimeter plaster beads.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Babcock-Davis; A Cierra Products Co.
 2. Dur-Red Products.
 3. J. L. Industries, Inc.
 4. Karp Associates, Inc.
 5. Larsen's Manufacturing Company.
 6. Milcor Inc.
 7. Nystrom, Inc.
- B. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
 1. Locations: Wall and ceiling surfaces.
 2. Door: Minimum 0.060-inch- thick sheet metal, set flush with exposed face flange of frame.

3. Frame: Minimum 0.060-inch- thick sheet metal with 1-inch- wide, surface-mounted trim.
 4. Hinges: Spring-loaded, concealed-pin type.
 5. Latch: Cam latch operated by flush key with interior release.
- C. Exterior Flush Access Doors and Frames with Exposed Trim: Weatherproof with extruded door gasket.
1. Locations: Wall surfaces, plaster soffits.
 2. Door: Minimum 0.040-inch- thick, metallic-coated steel sheet; flush panel construction with manufacturer's standard 2-inch- thick fiberglass insulation.
 3. Frame: Minimum 0.060-inch- thick extruded aluminum.
 4. Hinges: Continuous piano, zinc plated.
 5. Lock: Preparation to accept a 1 1/8 inch mortise cylinder.
 6. Interior Latch Release: Mechanism to allow for panel to open from interior side-standard on all panels.

2.3 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 attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
 2. Provide mounting holes in frames for attachment of units to metal framing.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
1. For cylinder lock, furnish two keys per lock and key all locks alike.
- E. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 084113 - ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior aluminum storefront framing for windows as indicated in drawings.
2. Exterior heavy duty aluminum door frames for wood stile and rail door by others as indicated in drawings.
3. All required integral hardware, accessories fasteners and structural reinforcing required for a complete durable water tight system.
4. Installation of glazing.

B. Related Sections:

1. Division 8 Section "Door Hardware" for hardware provided under that section.
2. Division 8 Section "Glazing" for Glazing Requirements to the extent not specified in this section.
3. Division 8 Section "Aluminum Windows" for punched openings.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Door hardware:

1.3 DEFINITIONS

- A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferring to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
 - d. Noise or vibration created by wind and by thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
 - g. Failure of operating units.

- C. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.
- D. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 20 lbf/sq. ft.
 - 1. Maximum Water Leakage: According to AAMA 501.1 no uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.
- E. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- F. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.
- G. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x deg F when tested according to AAMA 1503 or as otherwise required by the Title-24 Envelope requirements and as indicated in the drawings.
- H. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:
 - 1. Sound Transmission Class (STC): Minimum 30 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
 - 2. Outdoor-Indoor Transmission Class (OITC): Minimum 34 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.
- I. Design of Aluminum Framed Entrances and Storefronts shall meet the requirements of Chapters 16A and 24 of 2013 CBC.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.
- B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, minimum half size scaled details, and attachments to other work.
 - 1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior including adjacent flashing.
 - 2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

3. Indicate adjacent items furnished or installed by others.
- C. Samples for Initial Selection: Color charts for units with factory-applied color finishes to include standard and available special custom colors.
- D. Samples for Verification: For each type of exposed finish required and colors selected in manufacturer's standard sizes, minimum 4" x 6".
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- F. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- G. Warranties: Sample of special warranties as listed in this section.

1.6 QUALITY ASSURANCE

- A. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
- B. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
- C. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems 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. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Failure of operating components.
 - d. Water leakage through fixed glazing and framing areas.
 - e. Adhesive or cohesive sealant failures.

2. Warranty Period: Three years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
1. Warranty Period: 15 years from date of Substantial Completion for organic color coat finish and 10 years for anodic finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Oldcastle Building Envelope Series 3000 2"x4-1/2" Multi-Plane Center Set thermally broken storefront system or comparable product by one of the following to match or exceed the basis-of-design system in style, performance, interface with adjacent construction and color, submitted under provisions for substitutions per Section 01 25 00, a minimum of 14 days prior to bid date.
1. EFCO
 2. United States Aluminum.
 3. Kawneer North America

2.2 MATERIALS

- A. Aluminum: Extruded 6063-T6 alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209.
 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 4. Structural Profiles: ASTM B 308/B 308M.

2.3 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken with a structural thermal barrier.
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Center.
 4. Provide heavy duty or reinforced frames where supporting doors, including stops.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum or stainless steel with nonstaining, nonferrous shims for aligning system components.
- C. 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.
- D. Concrete and Masonry Inserts: Stainless steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- F. Exposed Flashing: Form exposed flashings from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.
- G. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Division 8 Section "Glazing." Storefront to accommodate 1" insulated glass assemblies unless specifically indicated otherwise or thicker assemblies are required for compliance with structural deflection criteria.
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 ENTRANCE DOOR SYSTEMS – NOT USED (by Section 08 14 00 & 08 14 29)

- A. Entrance Door Hardware: As specified in Division 8 Section "Door Hardware."

2.6 SLIDING SERVICE WINDOWS – NOT USED

2.7 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."
- B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

2.8 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. Framing Members, General: 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. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
 - 4. Physical and thermal isolation of glazing from framing members.
 - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 6. Provisions for field replacement of glazing from exterior.

7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 8. Provide integral door stops for doors provided by others (verify thickness),
- D. Storefront Framing: Fabricate components for assembly using a system that is compatible with the adjacent existing system.
- E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
- F. Entrance Doors: Provide by Section 08 14 00 and 08 14 29.
- G. Hardware Installation: Factory install hardware to frames to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
- 2.9 ALUMINUM FINISHES
- A. Color Anodic Finish: AAMA 611, AA-M12C22A41/A44, Class I, 0.7 mils or thicker.
1. Color: Etched, medium matter, clear anodic coating, clear anodized or etched, medium matte, dark bronze colored anodic coating as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify door opening size and hardware requirements with door suppliers for wood doors provide by others prior to beginning aluminum frame installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 non-movement joints.
 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
 6. Seal joints watertight unless otherwise indicated.
- B. Metal Protection:
1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior. Coordinate with installers of adjacent framing, finishes and flashings systems to assure a complete weathertight assembly at head, jambs and sill. Provide flashings compatible with storefront system where not indicated to be provided by other trades/sections as required for weathertight installation.
- D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" to produce weathertight installation.
- E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- F. Install glazing as specified in Division 8 Section "Glazing."
- G. Entrance Doors: Wood doors to be installed by others.
- H. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

- A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
 - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet vertically and 1/8 inch in 20 feet horizontally; 1/4 inch over total length.
 - 2. Alignment:
 - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
- B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 CLEANING

- A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.

END OF SECTION 084113

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. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
 - 2. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
- 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. State Building Codes, Local Amendments.
- E. 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. 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.
- F. 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.

1.4 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. 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.
- C. 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.
- D. 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.
- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

- F. 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.
- G. 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
- H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 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".

1.6 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 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.

1.7 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. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Five years for standard duty cylindrical (bored) locks and latches.
 - 2. Five years for exit hardware.
 - 3. Twenty five years for manual overhead door closer bodies.
 - 4. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

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:
 - 1. 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.
- C. 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 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified 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: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
 - a. Hager Companies (HA) - CB Series.
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 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. Manufacturers:
 - a. Hager Companies (HA).

2.3 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 Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
 - b. Securitron (SU) - EL-CEPT Series.
 - c. Von Duprin (VD) - EPT-10 Series.

2.4 DOOR OPERATING TRIM

- A. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls 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. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:
 - a. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.5 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.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 4. 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.
 5. Keyway: Match Facility Standard.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
 1. Conduct specified "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. Existing System: Field verify and key locks to match Owner's existing system.
- 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.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 2 (Standard Duty): ANSI/BHMA A156.2, Series 4000, Grade 2 certified.
 1. Locks are to be non-handed and fully field reversible.
 2. Manufacturers:

- a. Schlage (SC) - AL Series.

B. Narrow Stile Interconnected Locksets:

1. Interconnected locksets designed with a mortise case which contains both a latchbolt and deadbolt and allows simultaneous retraction of both the latchbolt and deadbolt with a single motion turning of the lever handle.
2. Locksets to be non-handed and available with a 1 1/8" or 1 1/2" standard backset.
3. Latchbolt and deadbolt shall be fabricated of wrought brass and bronze with a minimum 3/4" latchbolt throw and 1" deadbolt throw.
4. Manufacturers:
 - a. Adams Rite (AD) – 2190/2290 Series.

2.7 AUXILIARY LOCKS

- A. Cylindrical Deadlocks: ANSI/BHMA A156.36, Grade 1, cylindrical type deadlocks to fit standard ANSI 161 preparation and 1 3/8" to 1 3/4" thickness doors. Provide tapered collars to resist vandalism and 1" throw solid steel bolt with hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other locksets.
1. Manufacturers:
 - a. Schlage (SC) - B600 Series.

2.8 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.

2.9 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
1. 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.
 2. 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.
 3. 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.
 4. 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.
 5. 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.
 6. 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.
 7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:

- a. Von Duprin (VD) - 35A/98 XP Series.

2.10 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 including installation and adjusting information on inside of cover.
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. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
4. 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 physically handicapped, provide units complying with ANSI ICC/A117.1.
5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
7. 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 (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty 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 and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:

- a. Norton Door Controls (NO) - 7500 Series.

2.11 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 certified 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. Hiawatha, Inc. (HI).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).

2.12 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 NPFA 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. National Guard Products (NG).
 2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
 3. Reese Enterprises, Inc. (RE).

2.13 ELECTRONIC ACCESSORIES

- A. Switching Power Supplies: Provide power supplies with either single or dual voltage configurations at 12 or 24VDC. Power supplies shall have battery backup function with an integrated battery charging circuit and shall provide capability for power distribution, direct lock control and Fire Alarm Interface (FAI) through add on modules. Power supplies shall be expandable up to 16 individually protected outputs. Output modules

shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs.

1. Manufacturers:
 - a. Securitron (SU) - AQD Series.

2.14 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.

2.15 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. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 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. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. 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 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Section "Closeout Procedures" for project punch and reporting requirements including compliance with approved submittals and verification door hardware is properly installed, operating and adjusted.

3.5 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.

3.6 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.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 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 selection for the material and application.

B. Manufacturer's Abbreviations:

- 1. MK McKinney
- 2. HA Hager
- 3. PE Pemko
- 4. VD Von Duprin
- 5. SC Schlage
- 6. AD Adams Rite
- 7. SA SARGENT
- 8. KA Kaba Ilco

| | | |
|-----|----|------------|
| 9. | RO | Rockwood |
| 10. | NO | Norton |
| 11. | SU | Securitron |
| 12. | AL | Allegion |
| 13. | IV | Ives |
| 14. | OT | Other |

Hardware Sets

Set: 1.0: Doors: 01, 08 (General Office and Vocational/Training Room)

| | | | | |
|---|-------------------------------|---------------------------------|--------------|----|
| 1 | Continuous Hinge | 780-112HD (verify w/ door mtl.) | Clear | HA |
| 1 | Narrow Stile Lock (with trim) | 2190-303-303 (Square) | Match Door | AD |
| 1 | Cylinder | 26-098 | Match Door | SC |
| 1 | Thumbturn Cylinder | ADA7161 | Match Door | KA |
| 1 | Door Closer | LCN 4040 XP-72MC | Satin Nickel | AL |
| 1 | Doorstop | 471 EXP | Satin Nickel | RO |
| 1 | Threshold | Per Detail x FHSL14 | | PE |
| 1 | Gasket | By Door Manufacturer | | |
| 1 | Sweep | 18100CNB | Match Door | PE |

Set: 2.0: Doors: 02, 07 (Office, Vocational/Training Room)

| | | | | |
|---|----------------------|------------------------|--------------|----|
| 3 | Hinge | 5BB1 | Satin Nickel | IV |
| 1 | Entrance/Office Lock | ND SERIES Rhodes (RHO) | Satin Nickel | SC |
| 1 | Wall Stop | WS406/407CVX | Satin Nickel | IV |
| 3 | Silencer | 608 | | RO |

Set: 3.0: Doors: 03 (Storage)

| | | | | |
|---|----------------|------------------|--------------|----|
| 3 | Hinge | 5BB1 | Satin Nickel | IV |
| 1 | Storeroom Lock | ND Rhodes (RHO) | Satin Nickel | SC |
| 1 | Door Closer | LCN 4040 XP-72MC | Satin Nickel | AL |
| 1 | Wall Stop | WS406/407CVX | Satin Nickel | IV |
| 3 | Silencer | 608 | | RO |

Set: 4.0: 05, 06 (Restrooms)

| | | | | |
|---|----------------------------------|---------------------------------|--------------|----|
| 1 | Continuous Hinge | 780-112HD (verify w/ door mtl.) | Clear | HA |
| 1 | Privacy Lock w/ Status Indicator | ND Rhodes (RHO) | Satin Nickel | SC |
| 1 | Door Closer | LCN 4040 XP-72MC | Satin Nickel | AL |
| 1 | Wall Stop | WS406/407CVX | Satin Nickel | IV |
| 1 | Kickplate | K1050 10" High x CSK | Satin Nickel | RO |
| 3 | Silencer | 608 | | RO |

Set: 5.0: 04 (Break Room)

| | | | | |
|---|----------------------|---------------------------------|--------------|----|
| 1 | Continuous Hinge | 780-112HD (verify w/ door mtl.) | Clear | HA |
| 1 | Entrance/Office Lock | ND SERIES Rhodes (RHO) | Satin Nickel | SC |
| 1 | Door Closer | LCN 4040 XP-72MC | Satin Nickel | AL |
| 1 | Wall Stop | WS406/407CVX | Satin Nickel | IV |
| 3 | Silencer | 608 | | RO |

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows, including for storefronts.
 - 2. Door lites for doors not specified to include glazing.
 - 3. Interior borrowed lites.
 - 4. Fire rated glazing and framing system.
- B. Related Sections:
 - 1. Division 8 Section "Hollow Metal Doors, Windows and Frames"
 - 2. Division 8 Section "Prefinished Wood Doors" and "Aluminum Clad Wood Doors"
 - 3. Division 8 Section "Aluminum Framed Entrances, and Storefronts"

1.2 DEFINITIONS

- A. Manufacturers of Glass Products: 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. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for 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.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
2. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
 - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
 - b. Solar Heat Gain Coefficient: NFRC 200.
 - c. Solar Optical Properties: NFRC 300.

1.4 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For the following products, in the form of 12-inch- square Samples for glass.
 1. Each color of clear or tinted float glass.
 2. Fire rated glass.
 3. Insulating glass for each designation indicated.
 4. Laminated glass.
 5. For each color (except black) of exposed glazing sealant indicated.
- C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
 1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
 2. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.
- E. Product Test Listings and Reports: For each of the following types of glazing products:
 1. Insulating glass.
 2. Glazing sealants.
 3. Glazing gaskets.
 4. Fire Resistant Glazing
- F. Qualification Data: For installers.
- G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass coated float glass and insulating glass.
- B. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- C. Safety Glazing Products: Comply with CBC Section 2406, with testing requirements in 16 CFR 1201 and, for wired glass, with ANSI Z97.1.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
 2. Where glazing units, including Kind FT glass are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
- D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations 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. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
 2. Glazing Standards: GANA Glazing Manual and Sealant Manual
- E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
1. Insulating Glass Certification Council.
- F. Fire Rated Glass: Each lite shall bear a permanent, non-removable label of Underwriters Laboratories and/or Intertek Testing Services (Warnock-Hersey) certifying it for use in tested and rated fire protective assemblies.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
 - B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.
- 1.7 PROJECT 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.
- 1.8 WARRANTY
- A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 1. Warranty Period: 10 years from date of Final Completion.
 - B. Fire rated glazing and frame system: 5 years from date of Final Completion.

1.9 REFERENCES

- A. ASTM E 119 – Fire Tests of Building Construction Materials.
- B. ASTM E 2010 – Standard Test method for Positive Pressure Fire Tests of Window Assemblies.
- C. ASTM E 2074 – Standard Test Method for Fire Tests of Door Assemblies, including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
- D. ASTM F 1915 – Standard Test Methods for Glazing for Detention Facilities.
- E. CSFM – Fire Tests for Doors and Window Assemblies.
- F. GANA – Glazing Manual.
- G. GANA – Sealant Manual.
- H. NFPA 80 – Fire Doors and Windows.
- I. NFPA 251 – Fire Test for Fire Endurance of Building Construction and Materials.
- J. NFPA 252 – Standard Methods of Fire Tests of Door Assemblies.
- K. NFPA 257 – Standard on Fire Test for Window and Glass Block Assemblies.
- L. UL 9 – Fire Tests of Window Assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
 - 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - 5. Basis-of-Design Product: The design for each glazing product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 GLASS PRODUCTS - GENERAL

- A. Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.
 - 1. Comply with glass design requirements specified in Part 1 “Performance Requirements” article.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Comply with glass design requirements specified in Part 1 "Performance Requirements" article.
 2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 3. For uncoated glass, comply with requirements for Condition A.
 4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
 5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.
 6. Where indicated in drawing for Spandrel Glazing provide Kind HS float glass with ceramic frit on the backside (face 4) @ inner pane of dual glazed unit. Frit color to be selected by the Architect to match adjacent glass. Glass shall be a minimum of 1/4" thickness.
- C. Laminated Glass: ASTM C 1172, and complying with other requirements specified and with the following:
1. Interlayer: Polyvinyl butyral or cured resin of .03 inch thickness or as otherwise indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
 - a. For polyvinyl butyral interlayers, laminate lites in autoclave with heat plus pressure.
 - b. For cured-resin interlayers, laminate lites with laminated-glass manufacturer's standard cast-in-place and cured-transparent-resin interlayer.
 2. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.
- D. Wired Glass: ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Quality-Q-6; and of form and mesh pattern specified.
- E. Fire Rated Glass (20 minute door lites): ASTM E 2010, ASTM E 2074, monolithic, radiant heat reducing flat glass. Manufactured by Safti First, or approved Equal.
- F. Fire Rated Glazing (45 minute corridor wall windows): TGP Circular windows in field built framing with metal L-angles as indicated in drawings. Glazing to be minimum 3/16 inch thick impact resistant "Firelite" by TGP with 45 minute rating, tested in accordance ASTM E-163 and UKL I0C.
- G. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
1. Comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 2. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
 3. Sealing System: Dual seal, with primary and secondary sealants as follows:
 - a. Manufacturer's standard sealants.

4. Spacer Specifications: Manufacturer's standard spacer material and construction, color as selected by architect.

2.3 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
 1. EPDM, ASTM C 864.
 2. 1/8" x 3/8" closed cell PVC tape at fire rated glazing.

2.4 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will 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. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 1. Single-Component Neutral or Basic-Curing Silicone Glazing Sealants:
 - a. Available Products:
 - 1) Dow Corning Corporation; 790.
 - 2) GE Silicones; SilPruf LM SCS2700.
 - 3) Tremco; Spectrem 1 (Basic).
 - b. Type and Grade: S (single component) and NS (nonsag).
 - c. Class: 100/50.
 - d. Use Related to Exposure: NT (nontraffic).
 - e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.
 - 1) Use O Glazing Substrates: Coated glass and galvanized steel.
 - f. Applications: Glazing in steel window frames.

2.5 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. 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 with a Shore, Type A durometer 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).

2.6 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze 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. Refer to the glass schedule at the end of this section.
 - 1. MONOLITHIC FLOAT-GLASS UNITS
 - a. Uncoated Clear Float-Glass Units: Class 1 (clear) float glass annealed or Kind HS (heat-strengthened) float glass where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with system performance requirements Kind HS (heat-strengthened) float glass or Kind FT (fully tempered) float glass.
 - 1) Thickness: As indicated by drawings and schedule.
 - 2. LAMINATED GLASS
 - a. Clear glass (unless otherwise indicated for tint), thickness as indicated by drawings and schedule for sound, safety and/or security purposes.
 - 3. MONOLITHIC FIRE RATED-GLASS UNITS
 - a. As indicated in Sections 2.02, E and F.
 - 4. INSULATING-GLASS UNITS
 - a. Passive Solar Low-E Insulating-Glass Units:
 - 1) Basis-of-Design Product: PPG Clear Solarban 70 insulating glass or a comparable product.
 - 2) Overall Unit Thickness: 1 inch.
 - 3) Interspace Content: Argon gas
 - 4) Outdoor Lite: 1/4" annealed float glass.
 - a. Color: Clear by PPG Industries, Inc.
 - b. Kind FT (fully tempered) where indicated or required by codes for safety glazing.
 - 5) Indoor Lite: Clear annealed float glass 1/4 inch thick.
 - a. FT (fully tempered) where indicated or required by codes for safety glazing.
 - 6) Low-E coating on Number 2 layer at exterior windows.
 - 5. Color: All interior glazing shall be clear and exterior glazing shall have clear lites or shall be tinted where otherwise specifically indicated.
 - 6. Provide Kind HS (heat strengthened) glass in lieu of float glass where needed to resist thermal stresses induced by differential shading.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing, 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 system.
 - 3. Minimum required face or 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 will leave visible marks in the complete work.

3.3 GLAZING, GENERAL

- A. 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.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- 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 sealant-substrate 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 as follows:
 - 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 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.

3.5 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. 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; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. 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.

3.6 GLASS SCHEDULE

- A. Glass types for doors, windows in punched openings and storefront systems shall be as follows, unless otherwise indicated on drawings:
- B. Storefront Systems: Provide 1" insulated units per paragraph 2.06, A, 4 above.
- C. Aluminum Windows; See specifications section 08 51 13 Aluminum Windows. Window manufacturer to provide 1" insulating units per paragraph 2.06, A, 4 pre-installed in window frames.
- D. Aluminum clad wood doors: See specification Section 08 14 00. Door manufacturer to provide 1" insulating units per paragraph 2.06, A, 4 above, pre-installed in doors.

- E. Windows; 1/4" nominal clear laminated sound/safety glass: All non-fire-rated interior door and window locations, except as indicated otherwise for fire rated glazing.
- F. Corridor fire rated door lites: 3/8" clear 20 minute fire resistance rated glazing complying with CBC Section 715.4.3: All new interior one-hour fire rated corridor locations in 20 minute fire rated doors for door vision lite glazing (exempt from hose stream test). See paragraph 2.02 E.
- G. Corridor Fire Rated Windows: Fire Rated windows: 45 minute clear Firelite Glazing. See paragraph 2.02 F.

END OF SECTION 088000

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum board for walls and ceilings.
- B. Related Sections include the following:
 - 1. Division 05 Section "Cold-Formed Metal Framing" for metal framing and backing.
 - 2. Division 06 Section "Miscellaneous Carpentry" for wood framing and furring that supports gypsum board.
 - 3. Division 07 Section "Building Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
 - 4. Division 09 Section "Tile Backer Board" for cementitious backer units installed as substrates for ceramic tile.
 - 5. Division 09 painting Sections for primers applied to gypsum board surfaces.
 - 6. Division 09 Section "Gypsum Board Suspension System" for gypsum board support system at ceilings and soffits where indicated.
 - 7. Division 09 Section "Glass-Mat Gypsum Sheathing" for exterior gypsum wall sheathing.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch long lengths for each trim accessory indicated.
 - 2. Textured Finishes: 24 inch square size for each textured finish indicated and on same backing indicated for Work.

1.03 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.

1.04 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.05 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.01 PANELS, GENERAL

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

2.02 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.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Gypsum Co.
 - b. BPB America Inc.
 - c. G-P Gypsum.
 - d. National Gypsum Company.
 - e. Temple.
 - f. USG Corporation.
- B. Regular Type (Type "X" Fire Rated):
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- C. Type F. R. (Type C Fire Rated and impact resistant):
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- D. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board. Use Type C (Fire Rated where required for fire assemblies):
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
- E. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
 - 1. Core: 5/8 inch, Type F.R.
 - 2. Long Edges: Tapered.

- F. Very Hi-Impact Wallboard: reinforced fiber mesh for increased indentation and penetration resistance, ASTM 636 ASTM C1278, Type X, 5/8" thick, tapered edges, ends cut square. Provide at toilet rooms and other walls indicated for Acrovyn or FRP wall panels and at corridor walls and similar high traffic areas.
- G. Other types and thicknesses specifically indicated or otherwise required to achieve fire-rated and sound rated wall and ceiling assemblies.

2.03 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.04 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Reinforced Paper.
- 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 drying-type, all-purpose compound.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable-type sandable topping compound.
 - 5. Skim Coat: When a level 5 finish is required, for the final coat use setting-type, sandable topping compound.

2.05 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- C. Gypsum Board Adhesive:
 - 1. DAP Professional Drywall Construction Adhesive.
 - 2. Liquid Nails Drywall Adhesive.
- D. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
- E. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."
- F. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."
- G. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

2.06 TEXTURE FINISHES

- A. Finish: As recommended by textured finish manufacturer.
 - 1. Texture Finish: Water-based, job- mixed, drying-type texture finish for spray application.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) G-P Gypsum; Georgia-Pacific ToughRock Wall and Ceiling Texture.
 - 2) USG Corporation; Sheetrock Quick Spray Decorative Texture.
 - 2. Texture: Medium orange peel, smooth sand, light orange peel or match existing adjacent finish.
 - 3. Architect to approve samples prior to application.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance. Verify that all blocking, backing, strapping and framed openings as required for attachment of accessories, equipment, fixtures and cabinetry has been properly installed.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing full height with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally. Fully encapsulate interior side of insulated walls with gypsum board panels.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
 - 4. At fire-resistive wall and ceiling assemblies, install gypsum board panels cut tight to and around rafters, joints, blocking, beams and similar projections to provide full membrane protection to roof or floor deck above and/or to rated membrane applied to underside of roof/floor framing to achieve the fire protection required by referenced CBC UL or W-H assemblies and as indicated in drawings. Seal voids with fire resistant sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood or metal 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.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

3.03 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Regular Type: Vertical surfaces, unless otherwise indicated.

2. Type F.R.: Where required for fire-resistance-rated assembly Vertical surfaces, unless otherwise indicated.
 3. Ceiling Type: Ceiling surfaces.
 4. Moisture- and Mold-Resistant Type: At wet areas in restrooms.
- B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.04 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 84 in specific locations approved by Architect for visual effect and as indicated on the drawings.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
 2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use at exposed panel edges. Leave 1/4" space for caulk where abutting dissimilar materials.

3.05 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for acoustical tile and vinyl covered tackboard.
3. Level 3: Where indicated on the drawings.
4. 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.
5. Level 5: Where wall coverings are specified or where indicated for a very smooth/level finish.
 - a. Primer and its application to surfaces are specified in other Division 09 Sections.

3.06 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.07 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 09290

SECTION 09 30 00 - CERAMIC TILE

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for ceramic tile. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. Section Includes:
 - a. Ceramic tile.
 - b. Stone thresholds.
 - c. Waterproof membrane.
 - d. Crack isolation membrane.
 - e. Tile backing panels.
 - f. Metal edge strips.

C. Definitions

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

D. Performance Requirements

1. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - a. Level Surfaces: Minimum 0.6.
 - b. Step Treads: Minimum 0.6.
 - c. Ramp Surfaces: Minimum 0.8.

E. Submittals

1. Product Data: For each type of product indicated.
2. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
3. Samples:
 - a. 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.
OR
Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (300 mm) square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.

- b. Full-size units of each type of trim and accessory for each color and finish required.
 - c. Stone thresholds in 6-inch (150-mm) lengths.
 - d. Metal edge strips in 6-inch (150-mm) lengths.
 4. Qualification Data: For qualified Installer.
 5. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
 6. Product Certificates: For each type of product, signed by product manufacturer.
 7. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.
- F. Quality Assurance
1. Source Limitations for Tile: Obtain tile of each type and color or finish **OR** tile of each type **OR** tile of each color or finish **OR** tile, **as directed**, from one source or producer.
 - a. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
 2. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
 3. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
 - a. Stone thresholds.
 - b. Waterproof membrane.
 - c. Crack isolation membrane.
 - d. Joint sealants.
 - e. Cementitious backer units.
 - f. Metal edge strips.
 4. Preinstallation Conference: Conduct conference at Project site.
- G. Delivery, Storage, And Handling
1. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
 2. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
 3. Store aggregates where grading and other required characteristics can be maintained, and contamination can be avoided.
 4. Store liquid materials in unopened containers and protected from freezing.
 5. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.
- H. Project Conditions
1. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.2 PRODUCTS

A. Products, General

1. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - a. Provide tile complying with Standard grade requirements unless otherwise indicated.
2. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 1.2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
3. 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.
4. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - a. Where tile is indicated for installation in swimming pools, on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
5. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

B. Tile Products

1. Tile Type: Factory-mounted unglazed **OR** glazed, **as directed**, ceramic mosaic tile.
 - a. Composition: Porcelain **OR** Impervious natural clay or porcelain **OR** Vitreous or impervious natural clay or porcelain, **as directed**.
 - b. Module Size: as directed.
 - c. Thickness: 1/4 inch (6.35 mm) **OR as directed**.
 - d. Face: Plain **OR** Pattern of design indicated, **as directed**, with cushion edges.
 - e. Surface (for unglazed tile): Smooth, without **OR** Slip-resistant, with, **as directed**, abrasive admixture.
 - f. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
 - g. Tile Color and Pattern: As indicated by manufacturer's designations **OR** as selected from manufacturer's full range, **as directed**.
 - h. Grout Color: As indicated by manufacturer's designations **OR** as selected from manufacturer's full range, **as directed**.
 - i. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1) Base Cove: Cove, module size **as directed**.
 - 2) Base Cap for Portland Cement Mortar Installations: Bead (bullnose), module size **as directed**.
 - 3) Base Cap for Thin-Set Mortar Installations: Surface bullnose, module size **as directed**.
 - 4) Wainscot Cap for Portland Cement Mortar Installations: Bead (bullnose), module size **as directed**.
 - 5) Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size **as directed**.

- 6) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 - 7) External Corners for Portland Cement Mortar Installations: Bead (bullnose), module size **as directed**.
 - 8) External Corners for Thin-Set Mortar Installations: Surface bullnose, module size **as directed**.
 - 9) Internal Corners: Cove, module size **as directed**.
OR
Internal Corners: Field-buttet square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.
 - 10) Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.35 mm) across nominal 4-inch (100-mm) dimension.
2. Tile Type: Unglazed **OR** Glazed, **as directed**, square-edged quarry tile.
 - a. Face Size: **as directed**.
 - b. Thickness: 3/8 inch (9.5 mm) **OR** 1/2 inch (12.7 mm) **OR** 3/4 inch (19 mm), **as directed**.
 - c. Wearing Surface (for unglazed tile): Nonabrasive, smooth, **OR** Abrasive aggregate embedded in surface, **as directed**.
 - d. Finish (for glazed tile): **as directed**.
 - e. Tile Color and Pattern: **as directed**.
 - f. Grout Color: **as directed**.
 - g. For furan-grouted quarry tile, precoat with temporary protective coating.
 - h. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1) Base: Coved with surface bullnose top edge, **as directed**, **as directed**.
 - 2) Wainscot Cap: Surface bullnose, face size **as directed**.
 - 3) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 3. Tile Type: Unglazed **OR** Glazed, **as directed**, paver tile.
 - a. Composition: Porcelain **OR** Impervious natural clay or porcelain **OR** Vitreous or impervious natural clay or porcelain **OR** Natural clay or porcelain, **as directed**.
 - b. Face Size: **as directed**.
 - c. Thickness: **as directed**.
 - d. Face: Plain with square or cushion edges **OR** plain with square edges **OR** plain with cushion edges **OR** Pattern of design indicated, with square or cushion edges **OR** As indicated, **as directed**.
 - e. Finish (for glazed tile): Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
 - f. Tile Color and Pattern: **as directed**.
 - g. Grout Color: **as directed**.
 4. Tile Type: Glazed wall tile **OR** Decorative thin wall tile, **as directed**.
 - a. Module Size: **as directed**.
 - b. Thickness: **as directed**.
 - c. Face: Plain with modified square edges or cushion edges **OR** plain with modified square edges **OR** plain with cushion edges **OR** Pattern of design indicated, with

- d. manufacturer's standard edges, **as directed**.
- d. Finish: Bright, opaque **OR** Bright, clear **OR** Mat, opaque **OR** Mat, clear **OR** Semimat, opaque **OR** Semimat, clear **OR** Vellum, opaque **OR** Vellum, clear **OR** Crystalline, **as directed**, glaze.
- e. Tile Color and Pattern: As indicated by manufacturer's designations **OR** as selected from manufacturer's full range, **as directed**.
- f. Grout Color: As indicated by manufacturer's designations **OR** as selected from manufacturer's full range, **as directed**.
- g. Mounting: Factory, back mounted.
- h. Mounting: Pregrouted sheets of tiles factory assembled and grouted with manufacturer's standard white silicone rubber.
- i. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile, **as directed**. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1) Base for Portland Cement Mortar Installations: Coved, module size **as directed**.
 - 2) Base for Thin-Set Mortar Installations: Straight, module size **as directed**.
 - 3) Wainscot Cap for Portland Cement Mortar Installations: Bullnose cap, module size **as directed**.
 - 4) Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size **as directed**.
 - 5) Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
 - 6) External Corners for Portland Cement Mortar Installations: Bullnose shape with radius of at least 3/4 inch (19 mm) unless otherwise indicated.
 - 7) External Corners for Thin-Set Mortar Installations: Surface bullnose, same size as adjoining flat tile.
 - 8) Internal Corners: Field-buttet square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.
- 5. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as adjoining wall tile.
 - a. One soap holder with grab handle, **as directed**, for each shower and tub indicated.
 - b. One paper holder at each water closet.
 - c. Color and Finish: Match adjoining glazed wall tile **OR** as indicated by manufacturer's designations **OR** as selected from manufacturer's full range **OR** White, bright glaze, **as directed**.
- C. Thresholds
 - 1. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - a. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
 - 2. Granite Thresholds: ASTM C 615, with polished **OR** honed, **as directed**, finish.
 - a. Description: Uniform, fine **OR** medium, **as directed**, -grained, white **OR** gray **OR** black, **as directed**, stone without veining.
OR
Description: Match sample.
 - 3. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of 10 **OR** 12, **as directed**, per ASTM C 1353 or ASTM C 241 and with honed finish.

- a. Description: Uniform, fine- to medium-grained white stone with gray veining.
OR
Description: Match sample.
 4. Slate Thresholds: ASTM C 629, Classification I Exterior **OR** II Interior, **as directed**, with fine, even grain and honed finish.
 - a. Description: Uniform, black **OR** blue-black **OR** gray **OR** blue-gray **OR** green, **as directed**, stone and unfading.
OR
Description: Match sample.
- D. Tile Backing Panels
1. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.
 - a. Thickness: 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm) **OR** 5/8 inch (15.9 mm) **OR** as indicated, **as directed**.
 2. Fiber-Cement Underlayment: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.
 - a. Thickness: 1/4 inch (6.4 mm) **OR** 1/2 inch (12.7 mm) **OR** as indicated, **as directed**.
- E. Waterproof Membrane
1. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
 2. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
 3. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.
 4. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203- mm) nominal thickness.
 5. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, SBS-modified-bituminous sheet with woven reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
 6. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
 7. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
 8. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
 9. Urethane Waterproofing and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.
- F. Crack Isolation Membrane
1. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard **OR** high, **as directed**, performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
 2. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.

3. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.
4. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203- mm) nominal thickness.
5. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness.
6. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
7. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
8. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
9. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
10. Urethane Crack Isolation Membrane and Tile-Setting Adhesive: One-part, liquid-applied urethane, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process.

G. Setting Materials

1. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
 - a. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
 - b. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 1064 and ASTM A 82 except for minimum wire size.
 - c. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C 847.
 - 1) Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
 - 2) Base Metal and Finish for Exterior Applications: Zinc-coated (galvanized) steel sheet.
 - 3) Configuration over Studs and Furring: Flat.
 - 4) Configuration over Solid Surfaces: Self furring.
 - 5) Weight: 2.5 lb/sq. yd. (1.4 kg/sq. m) **OR** 3.4 lb/sq. yd. (1.8 kg/sq. m), **as directed.**
 - d. 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.
2. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
 - a. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.
3. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 - a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
OR
Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene- rubber liquid-latex additive at Project site.
 - b. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
4. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch (16

mm).

- a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

OR

Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene- rubber liquid-latex additive at Project site.

5. EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar (Thin Set): ANSI A118.11.
 - a. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - b. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene- rubber liquid-latex additive at Project site.
6. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - a. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.
7. Chemical-Resistant Furan Mortar: ANSI A118.5, with carbon filler.
8. Organic Adhesive: ANSI A136.1, Type I, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Grout Materials

1. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
2. Standard Cement Grout: ANSI A118.6.
3. Polymer-Modified Tile Grout: ANSI A118.7.
 - a. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

OR

Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
4. Water-Cleanable Epoxy Grout: ANSI A118.3.
 - a. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, and certified by manufacturer for intended use.
5. Chemical-Resistant Furan Grout: ANSI A118.5, with carbon filler.
6. Grout for PregROUTed Tile Sheets: Same product used in factory to pregROUT tile sheets.

I. Elastomeric Sealants

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

4. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
5. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout.

J. Miscellaneous Materials

1. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
2. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; half-hard brass **OR** white zinc alloy **OR** nickel silver **OR** stainless-steel, ASTM A 666, 300 Series, **as directed**, exposed-edge material.
3. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 - a. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
 - b. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
4. 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.
5. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

K. Mixing Mortars and Grout

1. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
2. Add materials, water, and additives in accurate proportions.
3. 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.

1.3 EXECUTION

A. Examination

1. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - a. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - b. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for

installations indicated.

- 1) Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - 2) Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 - c. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 - d. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile- setting material manufacturer.
2. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
3. 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.
4. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

C. Tile Installation

1. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - a. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - 1) Exterior tile floors.
 - 2) Tile floors in wet areas.
 - 3) Tile swimming pool decks.
 - 4) Tile floors in laundries.
 - 5) Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
 - 6) Tile floors composed of rib-backed tiles.
2. 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.
3. 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.
4. 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.
- a. 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.
 - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - c. 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.
5. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
- a. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
 - b. Quarry Tile: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
 - c. Paver Tile: 1/4 inch (6.35 mm) **OR** 3/8 inch (9.5 mm), **as directed**.
 - d. Glazed Wall Tile: 1/16 inch (1.6 mm).
 - e. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).
6. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
7. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
- a. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 - b. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants".
8. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
- a. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
 - b. Do not extend cleavage membrane, waterproofing or crack isolation membrane under thresholds set in dry-set portland cement or latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproofing or crack isolation membrane with elastomeric sealant.
9. Metal Edge Strips: Install at locations indicated **OR** where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile **OR** where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated, **as directed**.
10. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout- sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- D. Tile Backing Panel Installation
1. Install cementitious backer units and fiber-cement underlayment and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex- portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.
- E. Waterproofing Installation
1. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions

2. to produce waterproof membrane of uniform thickness and bonded securely to substrate.
Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.
- F. Crack Isolation Membrane Installation
1. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
 2. Do not install tile or setting materials over crack isolation membrane until membrane has cured.
- G. Cleaning And Protecting
1. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - a. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
 - b. 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.
 - c. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
 2. 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.
 3. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
 4. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.
- H. Exterior Tile Installation Schedule
1. Exterior Floor Installations:
 - a. Tile Installation F101: Cement mortar bed (thickset) bonded to concrete **OR** over waterproof membrane on concrete **OR** over waterproof membrane on concrete where indicated and bonded to concrete where membrane is not indicated, **as directed**; TCA F101 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation F102: Thin-set mortar on concrete **OR** over waterproof membrane on concrete **OR** over waterproof membrane on concrete where indicated and on concrete where membrane is not indicated, **as directed**; TCA F102.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR**

- Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
2. Exterior Wall Installations, Masonry or Concrete:
 - a. Tile Installation W201: Cement mortar bed (thickset) on metal lath over waterproof membrane; TCA W201 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation W202: Thin-set mortar; TCA W202.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - I. Interior Tile Installation Schedule
 1. Interior Floor Installations, Concrete Subfloor:
 - a. Tile Installation F111: Cement mortar bed (thickset) with cleavage membrane; TCA F111 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation F112: Cement mortar bed (thickset) bonded to concrete; TCA F112 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - c. Tile Installation F113: Thin-set mortar; TCA F113.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
 - d. Tile Installation F114: Cement mortar bed (thickset) with cleavage membrane; epoxy **OR** furan, **as directed**, grout; TCA F114 and ANSI A108.1B.
 - 1) Tile Type: as directed by the Owner.

- 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Water-cleanable epoxy **OR** Chemical-resistant furan, **as directed**, grout.
 - e. Tile Installation F115: Thin-set mortar; epoxy **OR** furan, **as directed**, grout; TCA F115.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Water-cleanable epoxy **OR** Chemical-resistant furan, **as directed**, grout.
 - f. Tile Installation F116: Organic adhesive **OR** Water-cleanable, tile-setting epoxy, **as directed**; TCA F116.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
 - g. Tile Installation F121: Cement mortar bed (thickset) on waterproof membrane; TCA F121 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - h. Tile Installation F122: Thin-set mortar on waterproof membrane; TCA F122.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Polymer-modified sanded **OR** unsanded, **as directed**, grout.
 - i. Tile Installation F125A: Thin-set mortar on crack isolation membrane; TCA F125A.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water-cleanable epoxy, **as directed**, grout.
 - j. Tile Installation F131: Water-cleanable, tile-setting epoxy; epoxy grout; TCA F131.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Water-cleanable epoxy grout.
 - k. Tile Installation F132: Water-cleanable, tile-setting epoxy on cured cement mortar bed bonded to concrete subfloor **OR** installed over cleavage membrane, **as directed**; epoxy grout; TCA F132.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Water-cleanable epoxy grout.
 - l. Tile Installation F133: Chemical-resistant furan mortar **OR** Water-cleanable, tile-setting epoxy, **as directed**; furan grout. TCA F133 except use water-cleanable, tile-setting epoxy instead of chemical-resistant furan mortar for setting tile.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Chemical-resistant furan grout.
2. Interior Floor Installations, Wood Subfloor:
- a. Tile Installation F121: Cement mortar bed (thickset) on waterproof membrane; TCA F121 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.

- 1) Tile Type: as directed by the Owner.
- 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- b. Tile Installation F141: Cement mortar bed (thickset) with cleavage membrane; TCA F141 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- c. Tile Installation F142: Organic adhesive; TCA F142.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- d. Tile Installation F143: Water-cleanable, tile-setting epoxy; epoxy grout; TCA F143.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Water-cleanable epoxy grout.
- e. Tile Installation F144: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA F144.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- f. Tile Installation F150/160: Thin-set mortar on exterior-glue plywood; TCA F150 or TCA F160.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: EGP latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
3. Interior Radiant Heat Floor Installations, Concrete Subfloor:
 - a. Tile Installation RH110: Thin-set mortar on crack isolation membrane; hydronic piping installed in concrete; TCA RH110.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.

- b. Tile Installation RH115: Thin-set mortar; electric radiant system encapsulated in thin-set mortar; TCA RH115.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- c. Tile Installation RH116: Thin-set mortar on crack isolation membrane; electric radiant system encapsulated in cementitious self-leveling underlayment; TCA RH116.
 - 1) Tile Type: as directed by the Owner.
 - 2) Cementitious Self-Leveling Underlayment: Specified in Division 03 Section "Hydraulic Cement Underlayment".
 - 3) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- 4. Interior Radiant Heat Floor Installations, Wood Subfloor:
 - a. Tile Installation RH130: Thin-set mortar on exterior-glue plywood; electric radiant system encapsulated in thin-set mortar; TCA RH130.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: EGP latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
 - b. Tile Installation RH135: Thin-set mortar on cementitious backer units or fiber cement underlayment; electric radiant system encapsulated in thin-set mortar; TCA RH135.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
 - c. Tile Installation RH140: Thin-set mortar on crack isolation membrane; electric radiant system encapsulated in cementitious self-leveling underlayment; TCA RH140.
 - 1) Tile Type: as directed by the Owner.
 - 2) Cementitious Self-Leveling Underlayment: Specified in Division 03 Section "Hydraulic Cement Underlayment".
 - 3) Thin-Set Mortar: Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- 5. Interior Wall Installations, Masonry or Concrete:
 - a. Tile Installation W202: Thin-set mortar; TCA W202.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex- **OR** Medium-bed, latex-, **as directed**, portland cement mortar.

- 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- b. Tile Installation W211: Cement mortar bed (thickset) bonded to substrate; TCA W211 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- c. Tile Installation W221: Cement mortar bed (thickset) on metal lath over waterproof membrane, **as directed**; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- d. Tile Installation W222: One-coat cement mortar bed (thickset) on metal lath over waterproof membrane, **as directed**; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation W223: Organic adhesive; TCA W223.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
6. Interior Wall Installations, Wood Studs or Furring:
 - a. Tile Installation W221: Cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W221 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR**

- Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- b. Tile Installation W222: One-coat cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W222 and ANSI A108.1A **OR ANSI A108.1B OR ANSI A108.1C, as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
 - c. Tile Installation W223: Organic adhesive on solid backing; TCA W223.
 - 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - d. Tile Installation W231: Cement mortar bed (thickset); TCA W231 and ANSI A108.1A **OR ANSI A108.1B OR ANSI A108.1C, as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - e. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - f. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment over cleavage membrane, **as directed**; TCA W244.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
 - g. Tile Installation W245: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant gypsum backer board; TCA W245.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
7. Interior Wall Installations, Metal Studs or Furring:
- a. Tile Installation W221: Cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W221 and ANSI A108.1A **OR ANSI A108.1B OR**

- ANSI A108.1C, **as directed**.
- 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- b. Tile Installation W222: One-coat cement mortar bed (thickset) over waterproof membrane, **as directed**, on solid backing; TCA W222 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
- 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- c. Tile Installation W223: Organic adhesive on solid backing; TCA W223.
- 1) Tile Type: as directed by the Owner.
 - 2) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- d. Tile Installation W241: Cement mortar bed (thickset); TCA W241 and ANSI A108.1B.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- e. Tile Installation W242: Organic adhesive on gypsum board; TCA W242.
- 1) Tile Type: as directed by the Owner.
 - 2) Grout: Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- f. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
- g. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment over cleavage membrane, **as directed**; TCA W244.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
- h. Tile Installation W245: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant gypsum backer board; TCA W245.
- 1) Tile Type: as directed by the Owner.

- 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
8. Bathtub Wall Installations, Wood, **OR** Metal, **as directed**, Studs or Furring:
- a. Tile Installation B413: Thin-set mortar **OR** Organic adhesive, **as directed**, on water- resistant gypsum board; TCA B413.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
9. Bathtub/Shower Wall Installations, Wood, **OR** Metal, **as directed**, Studs or Furring:
- a. Tile Installation B411: Cement mortar bed (thickset); TCA B411 and ANSI A108.1A.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation B412: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B412.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
 - c. Tile Installation B419: Thin-set mortar **OR** Organic adhesive, **as directed**, on coated glass-mat, water-resistant backer board; TCA B419.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded **OR** Water- cleanable epoxy, **as directed**, grout.
10. Shower Receptor and Wall Installations, Concrete or Masonry:
- a. Tile Installation B414: Cement mortar bed (thickset); TCA B414 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation B421: Thin-set mortar on waterproof membrane; TCA B421.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - c. Tile Installation B422: Thin-set mortar on waterproof membrane with integrated

- bonding flange for bonded membranes; TCA B422.
- 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
11. Shower Receptor and Wall Installations, Wood **OR** Metal, **as directed**, Studs or Furring:
- a. Tile Installation B414: Cement mortar bed (thickset); TCA B414 and ANSI A108.1A **OR** ANSI A108.1B **OR** ANSI A108.1C, **as directed**.
 - 1) Tile Type: as directed by the Owner.
 - 2) Bond Coat Mortar for Wet-Set Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Thin-Set Mortar for Cured-Bed Method: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 4) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - b. Tile Installation B415: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B415.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - c. Tile Installation B420: Thin-set mortar on coated glass-mat, water-resistant backer board; TCA B420.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Dry-set **OR** Latex-, **as directed**, portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - d. Tile Installation B421: Thin-set mortar on waterproof membrane over cementitious backer units or fiber cement underlayment; TCA B421.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.
 - e. Tile Installation B422: Thin-set mortar on waterproof membrane over cementitious backer units or fiber cement underlayment with integrated bonding flange for bonded membranes; TCA B422.
 - 1) Tile Type: as directed by the Owner.
 - 2) Thin-Set Mortar: Latex-portland cement mortar.
 - 3) Grout: Sand-portland cement **OR** Standard sanded cement **OR** Standard unsanded cement **OR** Polymer-modified sanded **OR** Polymer-modified unsanded, **as directed**, grout.

END OF SECTION 09 30 00

SECTION 095113 - ACOUSTICAL PANEL SUSPENDED CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes acoustical panels and exposed suspension systems for ceilings including all components and accessories for support, bracing and anchorage.
- B. Related Sections include the following:
 - 1. Division 09 Section "Acoustical Tile Ceilings" for ceilings consisting of mineral-base acoustical tiles used with concealed suspension systems, stapling, or adhesive bonding.

1.2 DEFINITIONS

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

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- long Samples of each type, finish, and color.
- C. Research/Evaluation Reports: For each acoustical panel ceiling and components.
- D. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
 - 2. Suspension System: Obtain each type through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
 2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
 - a. Smoke-Developed Index: 450 or less.
 - b. Flame Spread Index: 25 or less.
- C. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
1. T-24 CBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
1. Required Attendees: Architect, Owners Representative, Inspector, Mechanical Consultant, Electrical Consultant, General Contractor, Mechanical Contractor, and Electrical Contractor (lighting),
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
 - B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
 - C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.
- 1.6 PROJECT CONDITIONS
- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

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

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed, or one full box, whichever is lesser, as a minimum.
 - 2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
 - 3. Hold-Down Clips: Equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard 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 D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Armstrong World Industries, Inc.; "Minaboard Cortega" or "Fissured."
 - 2. Certaineed; Baroque.
 - 3. USG Interiors, Inc.; "Auratone", item #507.
 - 4. Other special panels with different size, edges, textures and patterns as indicated in drawings.

- B. Classification: Provide fire-resistance-rated Class A panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
 2. Pattern: CD or CE (perforated small holes and fissured). Ceiling Type C-4 to have 1" wide linear grooves 6" on center.
 3. Color: White.
 4. LR: Not less than 0.80.
 5. NRC: Not less than 0.55.
 6. CAC: Not less than 30.
 7. Edge/Joint Detail: Square for ceiling type C-2, Tegular for ceiling types C-3 and C-4.
 8. Thickness: 5/8 inch.
 9. Modular Size: 24 by 24 inches and 24 by 48 inches, as indicated by the drawings.
 10. Flame Spread Index: 25 or less.
 11. Smoke-Developed Index: 450 or less.
- C. Refer to finish schedule, ceiling plans, sections and details for other specialty acoustical panels that may have tegular edges, scored patterns, different textures and other features as indicated.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire (12 ga.).
- E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces or as indicated in drawings.
- F. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.
1. "Berc Clip" as manufactured by Armstrong World Industries, or approved equal, as indicated by drawings.
- G. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees and as required to hold vertical and steep slope panels in place.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Armstrong World Industries, Inc.; Prelude XL Heavy Duty (fire guard when required).
 2. Certainteed; Classic Stab, heavy duty.
 3. USG Interiors, Inc.; Standard DXL, heavy duty.
 4. Chicago Metallic Corporation, heavy duty.
- B. Wide-Face, Capped, Double-Web, Fire-Rated Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16-inch- wide metal caps on flanges.
1. Structural Classification: Heavy-duty system.
 2. End Condition of Cross Runners: Override (stepped) type.
 3. Face Design: Flat, flush.
 4. Cap Material: Steel or aluminum cold-rolled sheet.
 5. Cap Finish: Painted white.

2.5 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. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
 2. Shadow molding, Armstrong #7873, or approved equal, at dropped soffit walls and as otherwise indicated by the drawings.

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.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with T-24 CBC Standard 25-5, ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested and approved fire-rated design.

- 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 within 1-1/2". Wire turns made by machine where both strands have been deformed may exceed the 1 1/2" dimension, but the number of turns must be maintained, and must be as tight as possible. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. 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.
 - 6. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 7. Install compression struts with vertical hanger wire, spaced as indicated by the drawings, to inhibit vertical displacement.

- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns within 1-1/2". Suspend bracing from building's structural members as required for hangers.

- 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. Screw attach moldings to substrate at intervals 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.
 - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim, unless specifically indicated otherwise by the drawings.

- 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 a neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 2. 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.
 3. Arrange directionally patterned acoustical panels with the pattern running in one direction parallel to the short axis of the space unless indicated otherwise by the drawings.
 4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
 5. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.
- G. Lateral Bracing:
1. Provide lateral and uplift bracing as required by pertinent California codes and regulations for schools. Provide 4 sets of splayed bracing wires oriented 90 degrees from each other and spaced not more than 12'-0" each way. Provide bracing wires at locations not more than 6'-0" centers above each perimeter wall and at the edge of vertical ceiling offsets.
 2. Secure lateral brace to structural members. Secure at right angles to the direction of the partition and four ways in large ceiling areas.
 3. The slope of splay wires shall not exceed 45 degrees from the plane of the ceiling and be taught.
 4. Do not splice splay wires.
 5. Fasten splay wires with not less than four tight turns within a distance of 1-1/2".
 6. Provide uplift bracing of steel studs or metal EMT tubing at each point of lateral bracing as indicated, securely attached to main runner at ceiling and to floor/roof structure above as indicated and required by Division of the State Architect.

3.4 CLEANING

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

END OF SECTION 09 51 13

SECTION 096513 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Resilient Wall Base.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples of each resilient product color, texture, and pattern required.
- D. Product Schedule: For resilient products. Use same designations indicated on Drawings.

1.4 QUALITY ASSURANCE

- A. Installation Qualification: Contractors for floor covering installation should be experienced in managing commercial flooring projects and provide professional installers, qualified to install the various flooring materials specified. An installer is "qualified" if trained by Tarkett or a certified INSTALL (International Standards & Training Alliance) resilient floor covering installer.
- B. Mockups: Provide resilient products with mockups specified in other Sections.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Tarkett, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.6 PROJECT CONDITIONS

- A. Install resilient products after other finishing operations, including painting, have been completed.
- B. Maintain ambient temperatures within range recommended by Tarkett, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- C. Maintain the ambient relative humidity between 40% and 60% during installation.
- D. Until Substantial Completion, maintain ambient temperatures within range recommended by the manufacturer, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis-of-design manufacturer: Tarkett North America, Address: 30000 Aurora Rd., Solon, Ohio 44139, web: www.tarkettna.com, info@tarkett.com
- B. Provide basis of design product, or comparable product approved by Architect prior to bid from the list of manufacturers below:
 - 1. Burke Mercer Flooring Products; Molded Rubber Wall Base (Blue Bonnet color)
 - 2. Armstrong World Industries, Inc.; Color Integrated Rubber Wall Base.
 - 3. Azrock Commercial Flooring, DOMCO; Rubber Wall Base.
 - 4. Roppe Corporation; Pinnacle Rubber Base.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Flooring products shall comply with the 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."

2.3 RESILIENT MILLWORK CONTOURABLE WALL BASE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Johnsonite; A Tarkett Company; Millwork Silhouette or comparable product.

- B. Product Standard: Meets performance requirements for ASTM F 1861 Standard Specification for Resilient Wall Base, Type TP, Group 1.
- C. Specify length: 8 feet (2.4 m).
- D. Colors and Patterns: As selected by Architect from full range of industry colors.

E. Test Data:

- 1. Resistance to light, ASTM F1515: Passes
- 2. Resistance to chemicals, ASTM F925: Passes
- 3. ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class 1.

2.4 INSTALLATION MATERIALS

- A. Adhesives: as recommended by Tarkett to meet site conditions
 - 1. Tarkett 960 Cove Base Adhesive (Porous applications)
 - 2. Tarkett 946 Premium Contact Bond Adhesive (Non-porous applications)

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.
- B. 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.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to Tarkett's written instructions to ensure adhesion of resilient wall base.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with Tarkett'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 practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient wall 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.

3.4 CLEANING AND PROTECTION

- A. Comply with Tarkett's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
- 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.

END OF SECTION 09 65 13

SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces, as indicated on the drawings and schedules, and as specified herein.
1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
 2. Paint and finish exposed surfaces using the combination of materials listed on Painting Schedule in part 3 of this Section, as specified herein, and as needed for a complete and proper installation.
- B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish except when specifically noted otherwise.
 2. Priming or priming and finishing of certain surfaces may be specified to be factory-performed or installer-performed under pertinent other Sections. Said provisions DO NOT negate the primers required to be applied on-site where finishing is a part of this Section.
- C. Provide labor, materials, equipment, and services needed in areas of alteration work and new construction to clean and prepare the surfaces, and to paint including, but not necessarily limited to:
1. Interiors requiring painting of surfaces including gyp. board walls/ceilings, wood casework, trim, window panels/frames/sash, doors/frames and other similar items in the areas of work.
 2. Exterior:
 - a. Plaster building walls and misc trim where called for on the drawings. Paint the sections of the wall indicated as a part of the work from the ground to the roof deck, soffit or eave. Extend to end of wall or nearest complete panel joint. All new plaster and all patched or retextured plaster is to be painted to match existing adjacent surfaces.
 - b. Trim, window panels/frames/sash, doors/frames and other similar items in the area of work.
 3. Lead Based Paint: The District has retained a separate consultant to sample and test existing paint and coatings for detection of lead content in the area of work for this project. Refer to CLOVIS UNIFIED SCHOOL DISTRICT REQUIRED SPECIFICATIONS for LEAD BASED PAINT PROCEDURES and the LEAD BASED PAINT SURVEY by XRF as prepared by HMS, Inc. which are bound into this Project manual. Follow all procedures and applicable requirements of the LEAD BASED PAINT PROCEDURES for proper removal and handling of lead based paint within the areas of work for this project, based on the

XRF test results scheduled in the SURVEY FOR LEAD BASED PAINT. Samples were taken randomly to determine general extent of existing lead based paint and coatings. Other similar surfaces that correlate with those tested should be handled the same as if tested.

- D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and required labels.
1. Prefinished items include (but not necessarily limited to) the following factory-finished components:
 - a. Architectural woodwork.
 - b. Acoustical wall panels.
 - c. Metal lockers.
 - d. Finished mechanical and electrical equipment.
 - e. Light fixtures.
 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Furred areas.
 - b. Ceiling plenums.
 - c. Utility tunnels.
 - d. Pipe spaces.
 - e. Duct shafts.
 3. Finished metal surfaces include (but not necessarily limited to) the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper and copper alloys.
 - e. Bronze and brass.
 4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.
 - b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
 5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
 6. Sandblasted concrete: Do not paint unless so scheduled.
- E. Related Sections include the following:
1. Division I Section "Product Requirements".
 2. Division 32 Section "Pavement Markings" for traffic-marking paint.
 3. Division 5 Section "Structural Steel" for shop priming structural steel.
 4. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.

 5. Division 6 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
 6. Division 8 Section "Hollow Metal Doors and Window Frames" for factory priming steel doors and frames.
 7. Division 9 Section "Gypsum Board" for surface preparation of gypsum board.
- F. The Finish Schedules and descriptive notes indicated on the drawings, indicates the location of interior room surfaces to be painted or finished. The Schedule indications are general and do not necessarily define the detail requirements. Include all detailed

refinements and further instructions as may be given for the required complete finishing of all spaces and rooms. Interior Elevations, building Sections and Details, Room Finish Schedules and Color Schedules are all to be used in concert to determine requirements of this Section.

1.2 REFERENCES

- A. Green Seal Standard GS-11, Paints, First Edition, May 1993.
- B. Green Seal Standard GC-03, Anti Corrosive Paints, Second Edition, January 1997.
- C. SCAQMD – South Coast Air Quality Management District
 - 1. SCAQMD-1113 – Rule 1113, Architectural Coatings
- D. SJVAPCD – San Joaquin Valley Air Pollution Control District
 - 1. SJVAPCD Regulations – Local Regulations
- E. SSPC – Steel Structures Painting Council.

1.3 DEFINITIONS

- A. General: "Paint," as used herein, means coating systems materials including primers, emulsions, epoxy, enamels, stains, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats. Standard coating terms defined in ASTM D 16 apply to this Section.
 - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 - 2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 - 3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 - 4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 ADMINISTRATIVE REQUIREMENTS

Not used.

1.5 SUBMITTALS

- A. Product Data: Within 25 calendar days after the Contractor has received the Owner's Notice to proceed, submit, for each paint system indicated, (include block fillers and primers) the following:
 - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification. Submit only those products applicable to the project scope for work indicated in the drawings.
 - 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material. Data proving compliance with the specified requirements and regulations shall be submitted for inclusion with warranty and certification information to be retained by the Owner.

B. Samples

1. Following the selection of colors and glosses by the Architect, submit Samples for the Architect's review. If selection of colors/glosses has been scheduled, commence immediately with the sample submittal.
 - a. Provide five Samples of each color and each gloss for each material on which the finish is specified to be applied. Submittals will be reviewed for color and texture/finish only. Provide a listing of material and application for each coat of each finish sample.
 - b. Except as otherwise directed by the Architect, make Samples approximately 8" x 10" in size on materials simulating actual finished conditions.
 - c. On actual wood surfaces, provide 4" x 8" samples of natural and stained wood finish. Label and identify each as to location and application.
 - d. If so directed by the Architect, submit Samples during progress of the Work in the form of actual application of the approved materials on actual surfaces to be painted. Provide full-coat finish samples on at least 100 sq. ft. of surface as directed, until required sheen, color and texture is obtained; simulate finished lighting conditions for review of in-place work.
2. Revise and resubmit each Sample as requested until the required gloss, color, and texture is achieved. Such Samples, when approved, will become standards of color and finish for accepting or rejecting the work of this Section.
3. Do not commence finish painting until approved Samples are on file at the job site.

C. Qualification Data: For Applicator.

1.6 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Paint coordination:
 1. Provide finish coats which are compatible with the prime coats actually used. Provide priming, undercoating, coating and finishing products produced by a single manufacturer source. Use only thinners approved by the paint manufacturers, and use only within recommended limits. Insofar as practicable, use undercoat, finish coat, and thinner material as parts of a unified system of paint finish.
 2. Review other Sections of these Specifications as required, verifying the prime coats to be used and assuring compatibility of the total coating system for the various substrata.
 3. Upon request, furnish information on the characteristics of the specific finish materials to assure that compatible prime coats are used.
 4. Provide barrier coats over noncompatible primers, or remove the primer and reprime as required.
 5. Notify the Architect in writing of anticipated problems in using the specified coating systems over prime-coatings supplied under other Sections.
- C. Intent of the drawings is to have a completed product. Where work of the Contract disturbs existing finishes such that repair is required, said repair work is to be accomplished to logical architectural stopping points.

- D. Protect finished work from damage by other trades, workers and processes until work is turned over to the Owner. Provide temporary protective barriers and coverings when necessary.
- E. Protect other work/surfaces from damage, drips or overspray by using appropriate shields, tarps, masks, etc. Clean any errant paint from adjacent materials as required and in accordance with appropriate cleaning methods for both the paint and for the materials being cleaned.
- F. Regulatory Requirements:
 - 1. Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.
 - 2. Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to job going out to bid and before start of painting project.
 - 3. Comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).
 - 4. Conform to SJVAPCD Regulations for maximum VOC limits.
- G. Quality verification requirements: These specifications call for a per-coat dry film thickness. The Contractor shall have available upon 48 hours notice a spectrographic measuring device (or other appropriate device) able to measure total thickness should there be a question as to the number of coats or compliance with the overall film thickness requirements.
- H. Source Limitations: Obtain primers for each coating system from the same manufacturer as the finish coats.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 PROJECT CONDITIONS

- A. IF APPLICABLE: Do not apply solvent-thinned paints when the temperature of surfaces to be painted and the surrounding air temperatures are below 45° F, unless otherwise permitted by the manufacturer's printed instructions.
- B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F, unless otherwise permitted by the manufacturer's printed instructions.
- C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to

damp or wet surfaces, unless otherwise permitted by the manufacturer's printed instructions.

- 1. Painting may continue during inclement weather only if surfaces and areas to be painted are enclosed and heated (or cooled) within temperature limits specified by manufacturer during application and drying periods.
 - 2. Applications may also continue during inclement weather only within the temperature and humidity limits specified by the paint manufacturer as being suitable for use during application and drying periods.
- D. Avoid painting surfaces when exposed to direct sunlight.

1.9 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents and location where used. Deliver extra materials to Owner.
 - 1. Quantity: Furnish Owner with an additional 4 percent, but not less than 1 gal. or 1 case, as appropriate, of each material and color and gloss applied.

PART 2 – PRODUCTS

2.1 PAINT MANUFACTURER

A. Acceptable manufacturers:

1. Subject to compliance with requirements, the following is a list of manufacturers offering products which may be incorporated in the work. Other manufacturers approved in advance by the Architect, may be substituted in accordance with provisions of the Contract. Various manufacturers have been listed in the Paint Schedule at the end of this Section to establish and identify paint systems for the numerous finishes and substrates to establish cross references. Subject to comparison with the listings shown on the Paint Schedule, products of the following manufacturers may be used in lieu of those shown. Submit the manufacturer's equivalent painting system for each substrate and for each different finish for review by the Architect that is of equal or greater quality of performance and appearances as acceptable to Architect. Replace products listed with the latest equivalent paint, products, available from the manufacturers that have been updated for compliance with environmental regulations or for improved performance.
2. Approved Manufacturers: Subject to compliance with the requirements, manufacturers which offer products that may be used in the Work include, but are not limited to the following:
 - a. Frazee
 - b. Dunn Edwards Corporation
 - c. I.C.I. Glidden Pro
 - d. The Sherwin-Williams Company
 - e. Kelly-Moore

2.2 PAINT MATERIALS

- A. Paints: Provide Ready-Mixed, except field catalyzed coatings. Pigments shall be fully ground maintaining soft paste consistency, capable of being readily and uniformly dispersed to complete homogeneous mixture. Paints shall have good flowing and brushing properties and be capable of drying or curing free of streaks and sags.
- B. Acceptable materials: Provide the best professional quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers that comply with the current EPA rules and regulations in place where the project is located. Materials not displaying manufacturer's identification as a standard, best professional line product, and not complying with the EPA rules and regulations, will not be acceptable. The quantity of titanium dioxide, the use of clays, aluminum silicate, talc and the purity of acrylic materials are a few of the criteria which will be used by the Architect in determining equivalency of materials.
- C. Accessory Materials: Linseed oil, shellac, solvents, and other materials not specified but required to achieve required finishes shall be of high quality and approved by manufacturer.

- D. Proprietary names used to designate colors, materials or finishes are not intended to imply that products of above-named manufacturers are unacceptable or excluded where equivalent products are available.
- E. Paint Pigments shall be pure, unfading, applicable types suited to the substrates and services to which they are to be applied.

2.3 COLOR SCHEDULES

- A. The Contract Documents may contain a color schedule indicating intent for colors, textures and final finishes.

2.4 APPLICATION EQUIPMENT

- A. For application of the approved paint, use only such equipment as is recommended for application of the particular paint by the manufacturer of the particular paint, and as allowed by the rules and regulations (i.e. EPA) in place at the project location.
- B. Prior to use of application equipment, verify that the proposed equipment is actually compatible with the material to be applied, and that integrity of the finish will not be jeopardized by use of the proposed equipment.

2.5 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.
- B. If materials are not listed for items such as patching, provide quality patching materials specifically developed for the use, applied as per the manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
 - 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.
- C. Do not paint over dirt, dust, rust scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint finish.
- D. Beware of a condition known as "critical lighting". This condition causes shadows that accentuate even the slightest surface variations. A pigmented sealer will provide tooth for succeeding decorative coating, but "does not" equalize smoothness or surface texture. Any corrective action to drywall must be done by the drywall contractor prior to decorating.
- E. Follow all applicable procedures and requirements in the Lead Based Paint & Coating Removal Guidelines furnished by FUSD prior to applying new paint coatings.

3.2 PROTECTION

- A. Protect previously installed work and materials which may be affected by Work of this Section.
 1. Protect prefinished surfaces, lawns, shrubbery and adjacent surfaces against paint and damage.
 2. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or splatter from fouling surfaces to be painted.
 3. Protect surfaces, equipment, and fixtures from damage resulting from use of fixed, movable and hanging scaffolding, planking, and staging.

3.3 MATERIALS PREPARATION

- A. General:
 1. Mix and prepare paint materials in strict accordance with the manufacturers' recommendations.
 2. Maintain containers used in storage, mixing, and application of paint in a clean condition, free from foreign materials and residue.
- B. Stirring:
 1. Stir materials before application, producing a mixture of uniform density.
 2. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- C. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.4 SURFACE PREPARATION

A. General:

1. Perform preparation and cleaning procedures in strict accordance with the paint manufacturers' recommendations and instructions and as herein specified, for each particular substrate condition.
 - a. Provide barrier coats over incompatible primers or remove and reprime as required. Notify **Architect** in writing of any anticipated problems in using the specified coating systems with substrates primed by others.
 - b. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting each space or area, reinstall removed items without damaging treated surfaces by using workmen who are skilled in the necessary trades.
 - c. Clean each surface to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Schedule cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly painted surfaces.
 - d. Follow all applicable procedures and requirements in the Lead Based Paint & Coating Removal Guidelines furnished by FUSD prior to and during all preparation work.

B. Surface Preparation of NEW materials

1. Cementitious Materials:
 - a. Prepare cementitious surfaces of concrete, concrete block and cement plaster to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
 - b. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
 - c. Clean concrete and concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid, or other etching cleaner. flush floor with clean water to neutralize acid, and allow to dry before painting.
2. Wood surfaces:
 - a. Clean wood surfaces until free from dirt, oil, and other foreign substance with scrapers, mineral spirits, and sandpaper, as required.
 - b. Sandpaper smooth finished wood surfaces exposed to view, and dust off. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.
 - c. Unless specifically approved by the Architect, do not proceed with painting of wood surfaces until the moisture content of the wood is 12% or less as measured by a moisture meter.

3. Metal surfaces:
 - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
 - d. Thoroughly clean ferrous surfaces, which are not galvanized or shop-coated, of dirt, oil, grease, loose mill scale and other foreign substances by solvent or mechanical cleaning.
 - e. On galvanized surfaces, clean surface contaminants using non-petroleum based solvent for the initial cleaning, and then treat the surface thoroughly with phosphoric acid etch. Remove etching solution completely before proceeding.
 - f. Allow to dry thoroughly before application of paint.

- C. Surface preparation of existing surfaces:
 1. Clean all surfaces scheduled to receive new paint coatings free from all dirt, dust, oxidized paint film, loose particles and unsound paint coatings, and other foreign matter.
 2. Locate unsound plaster, gypsum board, and similar unsound areas, and patch as needed to provide a smooth substrate for application of the paint coating.
 3. Metal: Clean free from loose and unsound paint coatings and other surface contaminants which may impair the adhesion of the new paint coating.
 4. Wood:
 - a. Clean free from loose and unsound paint coatings and other surface contaminants which may impair the adhesion of new paint coatings.
 - b. Sand sharp edges of paint film to a smooth feathered edge.
 - c. Fill, sand, and otherwise repair as needed to provide a smooth substrate for application of the new coating.
 5. Stucco:
 - a. Clean free from all dirt and other foreign matter by the hydrowash method.
 - b. Provide a clean sound surface for the new paint coatings.
 - c. Repair cracks and voids to match the texture and plane of the area in which the repair occurs.
 - d. Remove graffiti (if any) prior to application of the new paint coatings.

3.5 PAINT APPLICATION

- A. General:
 1. Apply paint in accordance with manufacturer's directions and in strict compliance with all current EPA Standards, Rules and Regulations, and other governing regulations applicable at the time of application. Use applicators and techniques best suited for the substrate and type of material being applied.
 2. Paint colors, surface treatments, and finishes are indicated in "schedules" of the Contract Documents.
 3. Provide finish coats which are compatible with prime paints used.

4. Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color, and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surface areas.
 5. Paint surfaces behind moveable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.
 6. Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless indicated otherwise.
 7. Touch up shop-applied prime coats which have been damaged, and touchup bare areas prior to start of finish coats application.
 8. Slightly vary the color of succeeding coats.
 - a. Do not apply additional coats until the completed coat has been inspected and approved.
 - b. Only the inspected and approved coats of paint will be considered in determining the number of coats applied.
 9. Sand and dust between coats to remove defects visible to the unaided eye from a distance of five feet.
 10. Apply additional coats of fillers or primer to new materials such as stucco where needed to visually match the texture and sheen of adjacent existing surfaces that have been previously painted.
- B. Schedule Painting: Apply first-coat material to surfaces that have been cleaned, pre-treated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Apply prime coat on material which is required to be painted or finished, and which has not been prime coated by others. Recoat primed or sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
 2. Allow sufficient drying time between coats, modifying the period as recommended by the material manufacturer to suit adverse weather conditions.
 3. Do not apply successive coatings until dry to where the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and when the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- C. Minimum Coating Thickness: Apply each coat of materials at not less than manufacturer's recommended spreading rate, to establish a dry film thickness of not less than 1.2 mils or as recommended by the coating manufacturer.
- D. Brush applications:
1. Brush out and work the brush coats onto the surface in an even film.
 2. Completely cover to provide opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.

- E. Spray application:
 - 1. Except as specifically otherwise approved by the Architect, and allowed by governing regulations, confine spray application to metal framework and similar surfaces where hand brush work would be inferior.
 - 2. Where spray application is used, apply each coat to provide the hiding equivalent of brush coats.
 - 3. Do not double back with spray equipment to build up film thickness of two coats in one pass.

- F. For completed work, match the approved Samples as to texture, color, and coverage. Remove, refinish, or repaint work not in compliance with the specified requirements.

- G. Interior: Use "stipple" finish where enamel is specified. Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.

- H. Miscellaneous surfaces and procedures:
 - 1. Exposed mechanical/electrical items (not pre-finished):
 - a. Finish electric panels, access doors, conduits, pipes, ducts, grilles, registers, vents, and items of similar nature to match the adjacent wall and ceiling surfaces, or as directed.
 - b. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
 - c. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
 - d. Paint exposed piping, conduit and fittings, vents and jacks, pipe hangers and supports, electrical trays, piping shrouds, exposed equipment supports and frames.
 - 2. Exposed pipe and duct insulation:
 - a. Apply one coat of latex paint on insulation which has been sized or primed under other Sections; apply two coats on such surfaces when unprepared.
 - b. Match color of adjacent surfaces.
 - c. Remove band before painting, and replace after painting.
 - 3. Hardware:
 - a. Paint prime coated hardware to match adjacent surfaces;
 - b. Paint metal portions of head seals, jamb seals, and astragal seals to match the color of the door frame unless otherwise directed by the Architect.
 - 4. Wet areas:
 - a. In toilet rooms and contiguous areas, add an approved fungicide to paints.
 - b. For oil base paints, use 1% phenolmercuric or 4% tetrachlorophenol.
 - c. For water emulsion and glue size surfaces, use 4% sodium tetrachlorophenate.
 - 5. Equipment: Unless otherwise noted, paint the following equipment items:
 - a. Mechanical equipment and exposed roof HVAC Units and platforms.
 - b. Electrical Panels and switchgear
 - c. Accessory items
 - 6. Application to EXISTING previously painted areas: Areas and materials that are being REPAINTED may receive two coats of paint in lieu of the three specified.

Apply primer coat when there is any chance of lack of adhesion at existing previously painted walls.

7. Existing cabinets indicated to be painted, if previously painted, shall be prepared and painted inside as well as outside.

3.6 CLEAN-UP AND FINAL PROTECTION

- A. During the progress of work, remove paint splatters from window glass and other surfaces. Remove splattering paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finish surfaces.
- B. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to the Architect.
 1. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for the protection of their work after completion of painting operations.
 2. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.
 3. Remove all rubbish, paint cans, and accumulated materials resulting from work in each space or room. All areas shall be left in a clean, orderly condition.

3.7 PAINT SCHEDULE

- A. General:
 1. Materials required to complete the painting are herein specified and listed by material number and name for each type of finish and substrate, solely to establish a standard for kind, quality and function. Unlisted manufacturers of equivalent products, upon compliance with these specifications and with the requirements of specification Section "Product Substitutions", may submit their products for approval.
 2. Except for specialty items or as otherwise specified, all materials shall be by one manufacturer.

3.8 PAINTING SYSTEMS SCHEDULE

- A. Provide the following paint systems for the various substrates, as indicated. This list complied with the EPA rules and regulations at last checking. Changes in product compliance after the date listed above should be brought to the attention of the Architect.

3.9 PAINTING FINISHES

- A. Apply the following finishes to the surfaces specified and/or as scheduled on the finish and paint schedule on the Drawings. Apply all materials in accord with manufacturer's instructions on properly prepared surfaces and foundations coats. Manufacturers shall verify that the paint type specified is the appropriate product for the location and application depicted on the drawings.
 1. If not included in the Drawings, the Architect will issue a Color Schedule prior to start of painting to designate the various colors and locations required for work.

2. Apply additional primers, sealers and fillers in addition to the listed finish coats as required for the substrate and as recommended by the manufacturer.

DUNN-EDWARDS

ICI GLIDDEN PRO

SHERWIN WILLIAMS

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|-----------------------------|
| 1. EXTERIOR SYSTEMS: |
|-----------------------------|

a. Cement Plaster – Semi-Floss; 100% Acrylic:

| | |
|--|----------------|
| 1 st Coat: W709 Eff-Stop A24W300 Loxon | 3030 Bond Prep |
|--|----------------|

| | |
|--|----------------|
| 2 nd Coat: W701V Evershield B2WF51 Weathclad | 2200 Dulux Pro |
|--|----------------|

Previously Painted Cement Plaster:

Spot Prime Where Needed:

| | |
|--------------------------------|----------------|
| W709 Eff-Stop A24W300 Loxon | 3030 Bond Prep |
|--------------------------------|----------------|

| | | |
|---------------------------|----------------|----|
| W701V Evershield A-100 | 2200 Dulux Pro | A6 |
|---------------------------|----------------|----|

b. Concrete Tilt-Up – Semi*Gloss; 100% Acrylic:

| | | |
|--|----------------|---------|
| 1 st Coat: W709 Eff-Stop Loxon | 3030 Bond Prep | A24W300 |
|--|----------------|---------|

| | | |
|--------------------------------------|------------|----------|
| 2 nd Coat: W704V Acriflat | 2210 Durus | A6 A-100 |
|--------------------------------------|------------|----------|

Previously Painted Concrete Tilt-Up:

Spot Prime Where Needed:

f. Metal – Galvanized or Aluminum - Gloss:

Pretreatment:

| | | |
|-------------------|---------------------|--------------------------|
| Galva-Etch GE 123 | Jasco Prep & Primer | B71Y1 DTM Wash Primer |
|-------------------|---------------------|--------------------------|

| | | |
|---|--------------|-------------------------|
| 1 st Coat: W8 WB Syn Lustro Acrylic | 4202 Devflex | B66W1 DTM Primer |
|---|--------------|-------------------------|

| | | |
|---|--------------|--------------|
| 2 nd Coat: W960V Permagloss Gloss | 4208 Devflex | K34 Duration |
|---|--------------|--------------|

g. Wood – Paint Finish – Gloss: 100% Acrylic:

| | | |
|--------------------------------------|--------------|-----------------------------------|
| 1 st Coat: W708 E-Z Prime | 3210 Gripper | B51W20 Prep Rite Pro Black |
|--------------------------------------|--------------|-----------------------------------|

| | | |
|--|--------------|-----|
| 2 nd Coat: W960V Permagloss Duration Gloss | 4208 DevFlex | K34 |
|--|--------------|-----|

h. Wood – Stain Finish - Opaque:

| | | |
|--|------------------------------------|----------------------------|
| 1 st Coat: W704V Acri-Flat Mar Solid Color | 2600 Wood Pride Solid Stain | A16 Pro Solid Stain |
|--|------------------------------------|----------------------------|

| | |
|--|------------------------------------|
| 2 nd Coat: W704V Acri-Flat A16ProMar Solid Color | 2600 Wood Pride Solid Stain |
|--|------------------------------------|

i. Wood – Stain Finish – Semi-Transparent:

| | | |
|---|------------------------------------|----------------|
| Two Coats: WPT-3 Weather Pro WoodScapes Transparent | 2610 Wood Pride Flood Latex S/T | A15T5 Semi- |
|---|------------------------------------|----------------|

| | | |
|--|-------------------------------|--------------------------------|
| <p>2. INTERIOR FINISH – Enamel: The following enamel paints are to be used for the final interior enamel paint application as directed on the Finish Schedule and in accordance with the base coats specified in the following Subparagraphs.</p> | | |
| <u>DUNN-EDWARDS</u> | <u>ICI GLIDDEN PRO</u> | <u>SHERWIN WILLIAMS</u> |
| W960V Permagloss | 4208 Dev Flex | B21W51 ProClassic Gloss |
| W901 Permasheen | 1407 Dulux Semi Gloss | HP D18Q Eminence SG |

a. Gypsum Drywall:

| | | |
|---|---|-------------------|
| 1 st Coat: W101V Vinylastic | 1000-1200 Prep & Prime Prep-Rite Primer | B28W200 |
| 2 nd & 3 rd Coat: Gloss as directed | Glass as directed | Gloss as directed |

b. Plaster, Concrete:

| | | |
|--|--------------|-------------------------|
| 1 st Coat: W707V Unikote Rite | 3210 Gripper | B28W101 Prep Classic |
| 2 nd & 3 rd Coat: Gloss as directed Gloss as directed | | Gloss as directed |

c. Concrete Block:

| | | |
|--|-------------------|-------------------|
| 1 st Coat: W6329 Block Filler Filler | 4000 Block Filler | B25W25 Block |
| 2 nd & 3 rd Coat: Gloss as directed Gloss as directed | | Gloss as directed |

d. Wood:

| | |
|--|-------------------------|
| 1 st Coat: W707V Unikote B28W101 Prep Rite | 3210 Gripper Classic |
| 2 nd & 3 rd Coat: Gloss as directed Gloss as directed | Gloss as directed |

e. Metal Ferrous:

| | | |
|---|-------------------|-----------------------------|
| 1 st Coat: W715 Ultra Grip | 4020 Devflex | B66W1 DTM Acrylic Primer |
| 2 nd & 3 rd Coat: Gloss as directed | Gloss as directed | Gloss as directed |

f. Metal – Non Ferrous/Galvanized, Aluminum:

| | | |
|---|-------------------|-----------------------------|
| 1 st Coat: W715 Ultra Grip | 4020 Devflex | B66W1 DTM Acrylic Primer |
| 2 nd & 3 rd Coat: Gloss as directed directed | Gloss as directed | Gloss as |

g. Galvanized Metal - Doors:

| | | |
|--|--------------|-----------------------------|
| 1 st Coat: W715 Ultra Grip | 4020 Devflex | B66W1 DTM Acrylic Primer |
| 2 nd & 3 rd Coat: Gloss as directed Gloss as directed | | Gloss as directed |

| |
|--|
| 3. Finish – Stain and Lacquer - Satin |
|--|

a. Wood:

| | | |
|--|-----------------------|-------|
| 1 st Coat: V109 Stainseal II A67Fi Wood Classics | 1700 Wood pride Stain | Stain |
|--|-----------------------|-------|

| | |
|---|-------------------------|
| Jasco Paste Wood Filler Minwax Wood Filler | Jasco Paste Wood Filler |
|---|-------------------------|

| | | |
|--|-----------------------------------|---------------|
| 2 nd Coat: McCloskey 2000 Sanding Sealer | Gemini 200-0012 High Build Sealer | B44MJ91Sealer |
|--|-----------------------------------|---------------|

3rd & 4th Coat: MC 80-6841 Satin
A68 Wood Classics
Satin
Lacquer (275 voc) 1802 Woodpride Satin

4. Epoxy Coating – Interior (Finish – Gloss):

a. Wood:

1st Coat: W 715 Ultra-Grip 3210 Gripper Primer
B28W101 Prep Rite
Classic

2nd Coat: S-60 Water Base Epoxy 4408 Devoe Tru-Glaze B70
Water Based
(Rustoleum)
Catalyzed Epoxy

3rd Coat: S-60 Water Base Epoxy 4408 Devoe Tru-Glaze Epoxy
B70 Water Based
(Rustoleum)
Catalyzed Epoxy

b. Concrete:

1st Coat: Comex E-4000 Waterboone Epoxy Primer
2nd & 3rd Coat: S-60 Water Base Epoxy 4408 Tru-Glaze Epoxy
B70 Water Based
(Rustoleum)
Catalyzed Epoxy

c. Gypsum Drywall:

1st Coat: Comex E-4000 Waterborne Epoxy Primer
W 715 Ultra-Grip 3210 Gripper Primer B51W20 ProBlock
CONTRACT # 24-S-01

2nd & 3rd Coat: S-60 Water Base Epoxy 4408 Devoe Tru-Glaze B70 Water
Based

(Rustoleum) Catalyzed
Epoxy

d. Metal – Ferrous and Galvanized:

1st Coat: 43-5 Corrobar (ferrous) Devoe DevRan 203 Epoxy B66W1 DTM

43-7 Galv-Alum (galvanized) Primer B71Y1

(ferrous)
(galvanized)

2nd & 3rd Coat: S-60 Water Base Epoxy Devoe 4408 Tru-Glaze Epoxy B70 Water
Based

(Rustoleum) Catalyzed
Epoxy

5. Concrete Floor Sealers - Clear:

a. Concrete:

1st & 2nd Coats: Okon W-1 Waterproofing Rain Guard Micro Seal Oron W-1

Weatherproofing Concrete

END OF SECTION 09 91 00

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes, but is not exclusive to, the following:
1. Parking lot signage (verify/coordinate with site signage in Division 32).
 2. Accessible path of travel.
 3. Building and room identification.
 4. Restroom signage.
 5. Exit signage (non-illuminated).
 6. Occupancy signage.
 7. Miscellaneous signage

1.2 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, including construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for signs. Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 2. Provide message list, typestyles, and graphic elements, including tactile characters and Braille, and layout for each sign.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for each different type of sign.
- D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:
1. Panel Signs: Full-size Samples of each type of sign required.
 2. Dimensional Characters: Full-size Samples of each type of dimensional character (letter and number) required. Show character style, material, finish, and method of attachment.
 3. Approved samples will be returned for installation into Project.

1.4 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

- B. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- C. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines, Applicable requirements of CBC Section 11B-703 and the Americans with Disabilities Act Accessibility Guidelines (ADAAG).
- D. General: Provide signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of polymer finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image colors and sign lamination.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide standard products manufactured by Architectural Signing, Inc. 4082 Glencoe Ave Marina del Rey, CA. 90261 or a comparable product by another manufacturer, from those listed below, approved by the Architect in advance.
 - 1. ACE Sign Systems, Inc.
 - 2. Best Sign Systems Inc.
 - 3. Gemini Incorporated.
 - 4. Mohawk Sign Systems.

2.2 MATERIALS

- A. Steel:
 - 1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial or forming steel.
 - 2. Steel Members Fabricated from Plate or Bar Stock: ASTM A 529/A 529M or ASTM A 572/A 572/M, 42,00-psi minimum yield strength.
 - 3. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.

- B. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of 5005-H15.
- C. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
- D. Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating:
 - 1. Impact Resistance: 16 ft/lbf/in. per ASTM D 256, Method A.
 - 2. Tensile Strength: 9000lbf/sq. in. per ASTM D 638.
 - 3. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. per ASTM D 790.
 - 4. Heat Deflection: 265 deg. F at 264 lbf/sq. in. per ASTM D 678.
 - 5. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044.
- E. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:
 - 1. Edge Condition: Beveled.
 - 2. Corner Condition: Square (1/8" radius) unless indicated otherwise.
- F. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit panel sign construction and mounting conditions indicated. Factory-paint brackets in color matching Architect's sample.
- G. Graphic Content and Style: Provide sign copy that complies with CBC Section 11B-703 and requirements indicated on Drawings for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage. Where copy has not been determined or is not indicated, provide copy as selected by Architect. All indicated copy is subject to change without additional cost to Owner until released for production following approval by Owner and Architect.
- H. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with CBC Section 11B-703, ADA-ABA Accessibility Guidelines and 2013 CBC. Text shall be accompanied by California contracted (Grade 2) Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks in contrasting color from background.
 - 1. Panel Material: Photopolymer and Clear acrylic sheet with opaque color coating, subsurface applied (Non-Glare Finish).
 - 2. Raised-Copy Thickness: Not less than 1/32 inch raised letters in Sans Serif upper case characters.
 - 3. Braille shall have domed or rounded dots 1/10 inch on center in each cell with 2/10 inch space between cells and raised 1/40 inch above the background.
- I. Subsurface Copy: Apply minimum 4-mil- thick vinyl copy to back face of clear acrylic sheet forming panel face to produce precisely formed opaque image. Image shall be free from rough edges.
- J. Applied Copy: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing. Apply copy to glass and wall surfaces where indicated.
- K. Anchors and Inserts: Provide nonferrous-metal or stainless steel anchors and inserts for exterior installations and elsewhere as required for corrosion resistance.

Use epoxy set toothed steel or expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into stucco, concrete or masonry work.

2.3 DIMENSIONAL CHARACTERS

- A. Cast Characters: Form individual letters and numbers by casting. Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Comply with requirements indicated for finish, style, and size.
1. Material: Formed-acrylic sheet or metal as indicated.
- B. Fabricated Characters: Fabricate letters and numbers to required sizes and styles, using metals and thicknesses indicated. Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories. Comply with requirements indicated for finish, style, and size.
1. Acrylic: 3/4" inch thick.
 2. Character Height: As indicated.
 3. Character Style: As selected.

2.4 PANEL SIGNS / SYMBOLS

- A. Exterior and Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with CBC Section 11B-703 and the following requirements:
1. Acrylic Sheet: **0.125 inch** thick (Non-Glare Finish).
 2. Aluminum sheet: 0.080 inch thick (Non-Glare Finish).
 3. Edge Condition: Bullnose.
 4. Corner Condition: As indicated on drawings.
 5. Mounting: Unframed.
 - a. Wall mounted.
 - b. Manufacturer's standard non-corroding anchors for substrates encountered.
 6. Color: As selected by Architect from manufacturer's full range.
- B. Colored Coatings for Acrylic Sheet: For copy colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are Non-Glare UV and water resistant for three years for application intended.
1. Color: As selected by Architect from manufacturer's full range.
- C. Toilet Room Door Geometric Symbols: Refer to drawings for graphic layout. Provide door sign plaques with the following attributes:
1. Material: Cast-acrylic sheet (Non-Glare).
 2. Plaque color: As approved by Architect to contrast with door background color.
 3. Perimeter: Unframed with eased edge.
 4. Size: As indicated on drawings.
 5. Colors: As selected by Architect, subject to jurisdictional approval.

- D. Toilet Room Wall Signs: Refer to drawings for graphic layout. Provide door sign plaques with the following attributes:
1. Material: Cast-acrylic sheet (Non-Glare Finish).
 2. Plaque color: As selected by Architect from manufacturer's full range.
 3. Type color: As selected by Architect from manufacturer's full range.
 4. Perimeter: Unframed.
 5. Size: As indicated on drawings.
 6. Margins: As indicated on drawings.
 7. Text color: As selected by Architect from manufacturer's full range.
- E. Exit Signs: Accessible exit and exit route sign text and locations shall be as indicated by the drawings.
1. Material: Non-glare acrylic plate.
 2. Plaque color: As selected by Architect from manufacturer's full range.
 3. Perimeter: Unframed.
 4. Size: As indicated by the drawings and as required for length of text.
 5. General: Sub-surfaces Process, with raised letters with integral contracted (Grade 2) Braille centered below letters.
 6. Text:
- F. Room Identification Signs (Exterior and Interior): Sign locations shall be as indicated by the drawings.
1. Material: Non-glare acrylic plate.
 2. Plaque color: As selected by Architect from manufacturer's full range.
 3. Perimeter: Unframed with radiused corners.
 4. Size: As indicated by the drawings and as required for length of text.
 5. General: Sub-surfaces Process, with California Contracted integral Grade 2 braille copy.
 6. Text: As indicated on drawings.
 7. Locations: As indicated on drawings
- G. Occupancy Signs: Sign text and locations shall be as indicated by the drawings.
1. Material: Non-glare acrylic plate.
 2. Plaque color: As selected by Architect from manufacturer's full range.
 3. Perimeter: Unframed with radiused corner.
 4. Size: As indicated by the drawings and as required for length of text.
 5. General: Sub-surfaces Process, with raised letters.
 6. Text: As indicated on drawings.
- H. International Symbol of Accessibility Signs: As indicated by drawings.
1. Figure Symbols: Building Entrance Sign; Size: As indicated on drawings.
 2. Assistive Listening Systems: Provide symbol of Access for Hearing Loss in accordance with CBC Figure 11B-14C. Along with specific location for pick-up indicated by drawings.
- I. Metal Signs: General
1. Materials: Reflectorized sign shall be porcelain on steel with beaded text; galvanized steel post and concrete footing. See drawings for text.
 2. Type Imagery:
 - a. Type Style: As indicated on drawings.
 - b. Arrangement: Use standard spacing between letters, words, numbers, and lines; centered typically.

- J. Accessible Parking Signs: As indicated by drawings.
 - 1. Material: 0.080-inch aluminum or other noncorrosive material.
 - 2. Background Color: As indicated on drawings.
 - 3. Copy Material: Reflective vinyl.
 - 4. Mounting: As indicated on drawings.
- K. Symbols of Accessibility: Pressure-sensitive adhesive backing suitable for both exterior and interior applications.

2.5 FABRICATION

- A. General: Provide manufacturer's standard signs of configurations indicated.
 - 1. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.6 FINISHES, GENERAL

- A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. 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.

2.7 ACRYLIC SHEET FINISHES

- A. Colored Coatings for Acrylic Sheet: For copy colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for three years for application intended.

2.8 ACCESSORIES

- A. Applied Vinyl Film: Provide opaque non-reflective die cut vinyl film, 0.0035-inch minimum thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.
- B. Mounting Methods: Use concealed fasteners, double-sided vinyl tape or silicone adhesive as indicated and approved by Architect fabricated from materials that are not corrosive to sign material and mounting surface.
- C. Anchors and Inserts: Provide nonferrous-metal or stainless steel anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.9 FINISHES, GENERAL

- 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 strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within 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, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.
- C. Verify that items are sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent wall, preferably on right side. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door (centered 9" minimum from face of jamb on latch side of door).
- B. Wall-Mounted Exterior Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
 1. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes located 1/4" to 1/2" in from edges at all 4 corners as approved by Architect. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
- C. Wall-Mounted Interior Signs: Attach panel signs to wall surfaces using methods indicated below:
 1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
 2. Silicone-Adhesive Mounting: Use liquid-silicone adhesive recommended in writing by sign manufacturer to attach signs to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended in writing by sign manufacturer to hold sign in place until adhesive has fully cured.
 3. Where panel signs are scheduled or indicated to be mounted on glass, provide matching plate on opposite side of glass to conceal mounting materials.
- D. Bracket-Mounted Units: Provide manufacturer's standard brackets, fittings, and hardware as appropriate for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring devices to comply with manufacturer's written instructions.

E. Dimensional Characters: Mount characters using standard fastening methods recommended in writing by manufacturer for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

1. Projected Mounting: Mount characters at projection distance from wall surface indicated.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION

SECTION 102623 - DECORATIVE PROTECTION PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Decorative protection panels.

1.2 REFERENCES

- A. Reference Standards: In addition to requirements, comply with applicable provisions of following for design, materials, fabrication, and installation of component parts:
1. ANSI / NEMA LD-3: High Pressure Decorative Laminates.
 2. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
 3. GreenGuard Gold Indoor Air Quality Certified®
 4. Class 1/A Fire-rated (UL723/ASTM E-84).
 5. SEFA 8.1 approved.
 6. ASTM G 22 Bacterial Growth Resistance.
 7. ASTM E 162: Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
 8. IMO FTP: International Code for Application of Fire Test Procedures.
 9. IMO FTP Code Part 2: Smoke and Density Test.
 10. IMO FTP Code Part 5: Test for Surface Flammability.
 11. ISO: International Organization for Standardization.
 12. ISO 9001: Quality Management Systems.
 13. NFPA 101: Life Safety Code.

1.3 ACTION SUBMITTALS

- A. Product Data:
1. Product data for each specified product. Include manufacturer's technical data sheets and published instructions.
- B. Shop Drawings: Each installation.
1. Anchorages to other construction, including requirements for concealed supports.
 2. Use same unit designations used on Drawings.
- C. Color Chart: Provide actual color samples. Electronic color samples will not be accepted.
- D. Verification Samples: Not less than 5 by 7 inches (127 by 177.8 mm), for each type, color, pattern, and surface finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator and installer.
- B. Product Certificates: For the following:
1. Decorative protection panels.
- C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Manufacturer's written maintenance instructions.
- B. Manufacturer warranties transferrable to Owner.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in fabricating and installing decorative plastic laminate finished work with a minimum 3 years experience.
- B. Fabricator Qualifications: Shop that 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 with a minimum 3 years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Package and ready materials according to manufacturer's instructions.
- B. Do not deliver components until Project is fully enclosed.
- C. Store products inside building protected from light, heat and moisture and never store in contact with floor or outside wall surfaces. Do not expose to continuous direct sunlight.
 - 1. Store horizontally.
 - 2. Sheets must be handled by two people.
 - 3. Stored at a temperature per Formica Corporation technical guide requirements.
- D. Provide protective coverings of suitable material. Take special precautions at corners.

1.8 PROJECT CONDITIONS

- A. Coordinate sizes and locations of cut-outs and other related Work specified in other Sections to ensure that interior laminate construction can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide decorative protection panels with the following surface burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Source Limitations: Obtain decorative protection panels materials through one source from a single manufacturer.

2.2 MANUFACTURER

- A. Manufacturer:
 - 1. Basis of Design: Formica Corporation; HardStop Decorative Protection Panels.

a. Contact: <http://www.formica.com/en/us>

B. Decorative Protection Panels

1. Description: Decorative protection panels.
 - a. Impact resistant panels.
2. Panel Core Material: Treated fiberglass core. Class A Fire-rated.
3. Laminate Grade:
 - a. Grade H1, 0.0677 Inches - 0.0827 Inches (1.72mm-2.1mm).
4. Laminate Color(s):
 - a. As selected by Architect from manufacturer's line of available colors.
5. Laminate Finish:
 - a. -58 Matte.
 - b. -43 Artisan.
6. Laminate Application(s):
 - a. Wainscots.

2.3 ACCESSORY MATERIALS

A. Aluminum Trim Profiles for Seam Treatments:

1. Thicknesses:
 - a. All trims 0.055-inch.
 - b. Corner guard trim 0.065-inch.
2. Profile Types:
 - a. End caps.
3. Colors, Finish and Patterns:
 - a. Clear anodized.

B. Adhesives:

1. Bonding Laminate: Franklin Advanced Polymer adhesive recommended. See Formica technical guide for recommended adhesive by substrate type.

C. Sealant:

1. Color Coordinated Sealant: 100% silicone caulk material by Color-Rite Incorporated as recommended by Formica Corporation.

2.4 FABRICATION

- A. Conform to Formica Corporation standard practices, procedures, conditions including preconditioning, material recommendations, machining, equipment and workmanship.
- B. Router base should be clean and free of burrs and debris. Table saws should be clean, flat, and free of burrs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install decorative protection panels in accordance with manufacturer's installation instructions, approved submittals.
- B. Provide templates and rough-in measurements.
- C. Accessory Materials: Install in accordance with manufacturer's written installation instructions.

3.2 CLEANING AND PROTECTING

- A. Cleaning:
 - 1. Clean decorative protection panels and aluminum trims in accordance with manufacturer's instructions.
- B. Protection:
 - 1. Do not permit construction near unprotected surfaces.

END OF SECTION

SECTION 102800 - TOILET ROOM ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Toilet accessories in new construction.
- B. Related Sections include the following:
 - 1. Division 06 Section "Miscellaneous Carpentry" for framed openings and backing/blocking to accommodate and support accessories.
 - 2. Division 05 "Metal Framing".
 - 3. Division 09 "Finishes" for various adjacent finishes.

1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, finishes for each type of accessory specified and manufacturer's warranty.
- B. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Schedules and room designations indicated on Drawings in the product schedule.
- D. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.
- E. Shop drawings including floor plans and/or interior elevations at min. 1/4" per foot scale to indicate mounting locations and heights for all accessories and required backing.

1.3 QUALITY ASSURANCE

- A. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Schedules.
 - 1. Products of other manufacturers listed in Part 2 with equal characteristics, as judged solely by Architect, may be provided.
 - 2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.4 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Schedule at the end of this Section.
- B. Available Manufacturers:
 - 1. Provide all individual items from a single manufacturer, unless specifically indicated otherwise.
 - 2. Where indicated on the Drawings or otherwise required, provide the following items or equal products of another manufacturer approved in advance by the Architect. Use of Bobrick numbers and descriptions below are intended to represent the desired level of quality of workmanship, materials, gages, etc., and are not intended to limit the suppliers of these products. With Architects and Owners approval, other products may be used as an equal from those listed below:
 - a. American Dispenser Company.
 - b. Bradley Corporation.
 - c. Accessory Specialties.
 - d. Parker
 - e. Waltrous.
 - f. Fort James.
 - g. Bay West.
 - h. World Dryer.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.
- C. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.
- D. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.
- E. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper, and theft resistant when exposed, and of galvanized steel when concealed.
 - 1. Anchors and fasteners shall be capable of developing a retaining force commensurate with the strength of the accessory to be mounted, and well suited for use with the supporting structure.
 - 2. Where exposed fasteners are permitted, provide oval head fasteners with finish matching the accessory.

2.3 FABRICATION

- A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide

- printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
- B. All finishes shall be stainless steel, with satin finish, for all items of this Section unless specifically indicated otherwise
 - C. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.
 - D. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.
 - E. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.
 - 1. Provide galvanized steel backing sheet, not less than 0.034 inch and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.
 - F. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper and theft-resistant installation, as follows:
 - 1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Drawing Plans, Details, Notes and Interior Elevations for locations and mounting heights of all accessories. Verify all accessories can be mounted to comply with disabled access requirements per CBC Section 1115B and notify Architect of any conflicts prior to installing blocking/backing, cutting-in of openings and ordering of any related materials. Provide alternative units of equal or better quality and capacity to suite the specific accessory location. Paper towel dispensers, hair dryers, napkin dispensers and similar accessories located in accessible path of travel within toilet rooms shall not protrude more than 4" from the face of the wall along the accessible route to fixtures.
- B. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 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. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

- C. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.3 ADJUSTING AND CLEANING

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

3.4 SCHEDULE: In addition to accessories indicated in the Drawings, provide the following Product Items:

A. Grab Bars:

- 1. Grab bars: Series, sizes and locations per Architect's drawings.
 - a. Grab bar (W/C side wall) 48" (1 1/4" diameter)
 - b. Grab bar (W/C rear wall) 36" (1 1/4" diameter)
 - c. Provide 258 series anchor plate at toilet partitions and/or backing in wall to support a minimum 250 pound point load on grab bars.

B. Mirrors:

- 1. Tilt Mirror with Stainless Steel Frame, 24" x 36". Model: As indicated in the drawings.

END OF SECTION

SECTION 104413 - FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and cabinets for fire extinguishers.

1.2 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 and cabinets.
 - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
- D. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- C. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.4 WARRANTY

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

1.5 SEQUENCING

- A. Apply decals on field-painted, fire protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket 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. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - b. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - c. Larsen's Manufacturing Company.
 - d. Potter Roemer LLC.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 FIRE PROTECTION CABINET

- A. Basis-of-Design Product: J. L. Industries Ambassador model 1015 W10 or 1017 W10 With SAF-T-LOCK, factory painted, with vertical "FIRE EXTINGUISHER" decal; or a comparable product by one of the following:
 - 1. Kidde Fyrnetics.
 - 2. Larsen's Manufacturing Company.
 - 3. Potter Roemer; Div. of Smith Industries, Inc.
 - 4. Watrous; Div. of American Specialties, Inc.
- B. Cabinet Construction: Non-rated or rated as required by wall type as indicated on Drawings.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch- thick, fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Steel sheet.
- D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
 - 1. Rolled-Edge Trim: 2-1/2-inch

- E. Door Material: Steel sheet.
- F. Door Style: Center glass panel with frame.
- G. Door Glazing: Tempered break glass.
- H. Door Hardware: Manufacturer's standard door-operating hardware (that does not require grasping by persons with disabilities) of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide manufacturer's standard.
 - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- I. 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. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 - 3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet glazing.
 - 2) Application Process: Decals.
 - 3) Lettering Color: White.
 - 4) Orientation: Vertical.
 - 4. Alarm: Manufacturer's standard alarm that actuates when fire protection cabinet door is opened and that is powered by batteries.
- J. Finishes:
 - 1. Manufacturer's standard baked-enamel paint for the following:
 - a. Exterior of cabinet, door and trim except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet and door.
 - 2. Steel: Factory baked enamel or powder coat.

2.3 MOUNTING BRACKETS FOR PORTABLE EXTINGUISHERS

- A. Available Manufacturers:
 - 1. Provide mounting brackets from same manufacturer as extinguishers.
- B. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 1. Color: Red.
- C. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

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. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch- thick, fire-barrier material.
 - 3. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - 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.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 FINISHES, GENERAL

- 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.

3.2 PREPARATION

- A. Prepare recesses for 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 indicated below:
 - 1. Fire Protection Cabinets: 54 inches maximum above finished floor to top of cabinet or as indicated.

- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed 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.
- C. Identification: Apply decals at locations indicated.
- D. Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

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 104413

SECTION 133419 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Structural-steel framing.
 - 2. Metal roof panels.
 - 3. Metal wall panels.
 - 4. Accessories.

1.3 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.4 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site .
 - 1. Review methods and procedures related to metal building systems including, but not limited to, the following:
 - a. Condition of foundations and other preparatory work performed by other trades.
 - b. Structural load limitations.
 - c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Required tests, inspections, and certifications.

- e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.
2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
 - b. Structural limitations of purlins and rafters during and after roofing.
 - c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
 - d. Temporary protection requirements for metal roof panel assembly during and after installation.
 - e. Roof observation and repair after metal roof panel installation.
3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
 - b. Structural limitations of girts and columns during and after wall panel installation.
 - c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 - d. Temporary protection requirements for metal wall panel assembly during and after installation.
 - e. Wall observation and repair after metal wall panel installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Metal roof panels.
 - b. Metal wall panels.
 - c. Foamed-insulation-core metal panels.
 - d. Roof ventilators.
- B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
 1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
 2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
 3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
 - a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.

4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches :
 - a. Flashing and trim.
 - b. Gutters.
 - c. Downspouts.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: For the following products:
 1. Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
 2. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.
 3. Accessories: Nominal 12-inch- long Samples for each type of accessory.
- E. Delegated-Design Submittal: For metal building systems.
 1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer licensed by the State of California in responsible charge for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For erector manufacturer .
- B. Welding certificates.
- C. Letter of Design Certification: Signed and sealed by the qualified professional engineer in responsible charge. Include the following:
 1. Name and location of Project.
 2. Order number.
 3. Name of manufacturer.
 4. Name of Contractor.
 5. Building dimensions including width, length, height, and roof slope.
 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 7. Governing building code and year of edition.
 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- D. Material Test Reports: For each of the following products:
 1. Structural steel including chemical and physical properties.
 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 3. Tension-control, high-strength, bolt-nut-washer assemblies.

- 4. Shop primers.
 - 5. Nonshrink grout.
 - E. Field quality-control reports.
 - F. Sample Warranties: For special warranties.
- 1.8 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For metal panel finishes to include in maintenance manuals.
- 1.9 QUALITY ASSURANCE
- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
 - 2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located (State of California).
 - B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- 1.10 DELIVERY, STORAGE, AND HANDLING
- A. Deliver components, sheets, 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.
- 1.11 FIELD CONDITIONS
- A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.12 WARRANTY

- A. Special Warranty on Metal Panel Finishes: 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 D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Buildings Company; a Nucor Company.
 2. Butler Manufacturing Company; a division of BlueScope Buildings North America, Inc.
 3. Nucor Building Systems.
 4. Star Building Systems; a division of NCI Building Systems, Inc.
 5. Varco-Pruden Buildings; a division of BlueScope Buildings North America, Inc.
- B. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

- A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
- B. Primary-Frame Type:
1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
 2. Rigid Modular: Solid-member, structural-framing system with interior columns.

- C. End-Wall Framing: Engineer end walls to be expandable. Provide primary frame, capable of supporting full-bay design loads, and end-wall columns.
- D. Secondary-Frame Type: Manufacturer's standard purlins and joists and exterior-framed (bypass) girts.
- E. Eave Height: As indicated on Drawings.
- F. Bay Spacing: As indicated on Drawings .
- G. Roof Slope: As Indicated on Drawings.
- H. Roof System:
- I. Exterior Wall System: Manufacturer's standard exposed-fastener, tapered-rib, metal wall panels.

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal building system.
- B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. Design Loads: As indicated on Drawings .
 - 2. Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
 - 3. Deflection and Drift Limits: No greater than the following:
 - a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
 - b. Girts: Horizontal deflection of 1/180 of the span.
 - c. Metal Roof Panels: Vertical deflection of 1/240 of the span.
 - d. Metal Wall Panels: Horizontal deflection of 1/180 of the span.
 - e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - f. Lateral Drift: Maximum of 1/200 of the building height.
- C. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 .
- 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: 120 deg F , ambient; 180 deg F , material surfaces .
- E. Fire-Resistance Ratings: Where assemblies are indicated to have a fire-resistance rating, provide metal panel assemblies identical to those of assemblies tested for fire resistance

per ASTM E 119 or ASTM E 108 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory," FM Global's "Approval Guide," or from the listings of another qualified testing agency.
- F. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
1. Wind Loads: As indicated on Drawings.
- G. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 or ASTM E 331 at the following test-pressure difference:
1. Test-Pressure Difference: 2.86 lbf/sq. ft. .
- H. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
1. Uplift Rating: UL 60
- I. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
1. Fire/Windstorm Classification: Class 1A- 60

2.4 STRUCTURAL-STEEL FRAMING

- A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
- B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
 2. Rigid Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.

3. Frame Configuration: Single gable
 4. Exterior Column: Tapered.
 5. Rafter: Tapered.
- E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
1. End-Wall Rafters: I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
- F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch- wide flanges.
 - a. Depth: As needed to comply with system performance requirements .
 2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch- wide flanges.
 - a. Depth: As required to comply with system performance requirements
 3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
 4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch-diameter, cold-formed structural tubing to stiffen primary-frame flanges.
 5. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
 6. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- G. Bracing: Provide adjustable bracing perpendicular to main frames as follows:
1. Rods: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 ; or ASTM A 529/A 529M, Grade 50 ; minimum 1/2-inch- diameter steel; threaded full length or threaded a minimum of 6 inches at each end.
 2. Cable: ASTM A 475, minimum 1/4-inch- diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded end anchors.
 3. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
- H. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.
- I. Materials:
1. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55 ; or ASTM A 529/A 529M, Grade 50 or 55
 2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55 ; or ASTM A 529/A 529M, Grade 50 or 55

3. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55 ; or ASTM A 529/A 529M, Grade 50 or 55
 4. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 5. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.
 6. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55 , or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70 ; or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80 , or HSLAS, Grades 45 through 70
 7. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, SS, Grades 33 through 80 , or HSLAS or HSLAS-F, Grades 50 through 80 ; with G60 coating designation; mill phosphatized.
 8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, SS, Grades 33 through 80 , or HSLAS or HSLAS-F, Grades 50 through 80 ; with G90 coating designation.
 - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, SS, Grade 50 or 80 ; with Class AZ50 coating.
 9. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.
 - a. Finish: Hot-dip zinc coating, ASTM F 2329, Class C .
 10. High-Strength Bolts, Nuts, and Washers: ASTM F 3125/F 3125M, Grade A325 , Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436/F 436M, Type 1, hardened carbon-steel washers.
 - a. Finish: Hot-dip zinc coating, ASTM F 2329, Class C .
 11. High-Strength Bolts, Nuts, and Washers: ASTM F 3125/F 3125M, Grade A490 Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436/F 436M, Type 1, hardened carbon-steel washers; all with plain finish.
 12. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 3125/F 3125M, Grade F1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436/F 436M, Type 1 hardened carbon-steel washers.
 - a. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50 .
 13. Unheaded Anchor Rods: ASTM F 1554, Grade 36 .
 - a. Configuration: Straight.
 - b. Nuts: ASTM A 563 hex carbon steel.
 - c. Plate Washers: ASTM A 36/A 36M carbon steel.
 - d. Washers: ASTM F 436 hardened carbon steel.
 - e. Finish: Hot-dip zinc coating, ASTM F 2329, Class C .
 14. Threaded Rods: ASTM A 36/A 36M .
 - a. Nuts: ASTM A 563 hex carbon steel.
 - b. Washers: ASTM A 36/A 36M carbon steel.
 - c. Finish: Hot-dip zinc coating, ASTM F 2329, Class C .
- J. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

1. Clean and prepare in accordance with SSPC-SP2.
2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil .
 - a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

2.5 METAL ROOF PANELS

- A. Standing-Seam, Vertical-Rib, Metal Roof Panels : Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.030-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: Three-coat fluoropolymer .
 - b. Color: As selected by the District to match surrounding buildings on site.
 2. Clips: Two-piece floating to accommodate thermal movement.
 3. Joint Type: Mechanically seamed.
 4. Panel Coverage: 16 inches .
 5. Panel Height: 2 inches .
- B. Finishes:
1. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Concealed Finish: Apply pretreatment and 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

2.6 METAL WALL PANELS

- A. Exposed-Fastener, Tapered-Rib, Metal Wall Panels : Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.030-inch nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Exterior Finish: Three-coat fluoropolymer .
 - b. Color: As selected by the District to match surrounding Buildings on site.
 2. Major-Rib Spacing: 6 inches o.c.
 3. Panel Coverage: 36 inches .
 4. Panel Height: 1.25 inches .
- B. Finishes:

1. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and 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 .

2.7 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
 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.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
 2. Clips: Manufacturer's standard, formed from steel sheet, designed to withstand negative-load requirements.
 3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from steel sheet.
 4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 5. 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 roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 6. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch standoff; fabricated from extruded polystyrene.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall 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 wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

- D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.
1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
1. Gutter Supports: Fabricated from same material and finish as gutters.
 2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- long sections, complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters.
- G. Materials:
1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 - a. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
 - b. Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
 - c. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws , with EPDM sealing washers bearing on weather side of metal panels.
 - d. Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head , with EPDM sealing washers bearing on weather side of metal panels.
 - e. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - f. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
4. Metal Panel Sealants:
 - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
 - b. Joint Sealant: ASTM C 920; one part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.8 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
 1. Make shop connections by welding or by using high-strength bolts.
 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
 1. Make shop connections by welding or by using non-high-strength bolts.
 2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
 - 1. Engage land surveyor to perform surveying.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 2. Locate and space wall girts to suit openings such as doors and windows.
 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
1. Tighten rod and cable bracing to avoid sag.
 2. Locate interior end-bay bracing only where indicated.
- I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.
- 3.4 METAL PANEL INSTALLATION, GENERAL
- A. 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. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 - 1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
- D. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 - 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
 - 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Locate metal panel splices over structural supports with end laps in alignment.
 - 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- E. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
 - 1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
 - 1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.

3.5 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
1. Install ridge caps as metal roof panel work proceeds.
 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
1. Install clips to supports with self-drilling or self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
 5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Pre-drill panels for fasteners.
 6. Provide metal closures at peaks rake edges rake walls and each side of ridge caps.
- C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
 2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
 3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
 4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- E. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless

otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 2. Shim or otherwise plumb substrates receiving metal wall panels.
 3. When two rows of metal panels are required, lap panels 4 inches minimum.
 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Pre-drill panels.
 6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 7. Install screw fasteners in pre-drilled holes.
 8. Install flashing and trim as metal wall panel work proceeds.
 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
- C. Insulated Metal Wall Panels: Install insulated metal wall panels on exterior side of girts. Attach panels to supports at each panel joint using concealed clip and fasteners at maximum 42 inches o.c., spaced not more than manufacturer's recommendation. Fully engage tongue and groove of adjacent insulated metal wall panels.
1. Install clips to supports with self-tapping fasteners.
 2. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels as weather seal.
- D. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, noncumulative; level, plumb, and on location lines; and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 ACCESSORY INSTALLATION

- A. General: 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 roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. 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. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant 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 or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
1. Provide elbows at base of downspouts to direct water away from building.
 2. Tie downspouts to underground drainage system indicated.

3.8 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.
- B. Product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.
- B. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.

1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 133419

SECTION 200100 - GENERAL MECHANICAL PROVISIONS

GENERAL

1.1 GENERAL CONDITIONS

- A. The preceding General Conditions shall form a part of this Section with the same force and effect as though repeated here. The provisions of this Section shall also apply to the following Divisions 21, 22, 23 and 25 of these Specifications and shall be considered a part of those Divisions.

1.2 CODES AND REGULATIONS

- A. All work and materials shall be in accordance with current rules and regulations of applicable codes. Nothing in these Drawings or Specifications is to be construed to permit work not conforming to these codes. Should the Drawings or Specifications call for material or methods of construction of a higher quality or standard than required by these codes, the Drawings and Specifications shall govern. Applicable codes and regulations include, but are not necessarily limited to, the following:

| | |
|----------------------------|----------------------|
| California Building Code | CCR Title 24, Part 2 |
| California Electrical Code | CCR Title 24, Part 3 |
| California Mechanical Code | CCR Title 24, Part 4 |
| California Plumbing Code | CCR Title 24, Part 5 |
| California Energy Code | CCR Title 24, Part 6 |
| California Fire Code | CCR Title 24, Part 9 |
| Local Codes | |

1.3 DEFINITIONS

- A. Provide: The term "provide" as used in these specifications or on the drawings shall mean furnish and install.
- B. Piping: The term "piping" as used in these specifications or on the drawings shall mean all pipe, fittings, valves, hangers, insulation, etc. as may be required for a complete and functional system.
- C. Ductwork: The terms "duct" or "ductwork" as used in these specifications or on the drawings shall mean all ducts, fittings, joints, dampers, hangers, insulation, etc. as may be required for a complete and functional system.
- D. Wiring: The term "wiring" as used in these specifications or on the drawings shall mean all wiring, conduit, boxes, connections, transformers, relays, switches etc. as may be required for a complete and functional system.

1.4 PERMITS AND FEES

- A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required. All charges are to be included in the work.

1.5 COORDINATION OF WORK

- A. Examination: Before starting work, thoroughly examine existing and newly completed underlying and adjoining work and conditions on which the installation of this work depends. Report to the Engineer in writing all conditions which might adversely affect this work.
- B. Layout: Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. Some work may be shown offset for clarity. The actual locations of all materials, piping, ductwork, fixtures, equipment, supports, etc. shall be carefully planned prior to installation of any work in order to avoid all interference with each other, or with structural, electrical, architectural or other elements.
- C. Verification: If discrepancies are discovered between drawing and specification requirements, the more stringent requirement shall apply. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment. No work shall be prefabricated or installed prior to this coordination. No costs will be allowed to the Contractor for any prefabrication or installation performed prior to this coordination. Verify the proper voltage and phase of all equipment with the electrical plans.
- D. Location of Utilities Prior to Trenching or Earthwork: The Contractor shall notify the Owner a minimum of two business days prior to beginning trenching or earthwork. Prior to this notification, the Contractor shall have marked all proposed trenches with paint and shall have contacted a utility locating company and have had this company mark all found underground utilities with paint. The Contractor shall then coordinate and arrange for a site visit with the Owner to review the proposed trenching and/or earthwork areas. Trenching and/or earthwork shall not begin until the Owner agrees. Repair and/or compensation for repair of marked utilities is the responsibility of the Contractor. The Owner retains the right to either self-perform the repair or require the Contractor to complete the repair, as directed by the Owner. If while performing the work, the Contractor discovers utilities that have not been marked, the Contractor shall immediately notify the Owner verbally and in writing.

1.6 GUARANTEE

- A. Guarantee shall be in accordance with the General Conditions. The Contractor shall repair any defects due to faulty materials or workmanship and pay for any resulting damage to other work which appears within the guarantee period. These Specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the certificate of guarantee shall be furnished to the Owner through the Engineer.

1.7 QUIETNESS

- A. Piping, ductwork and equipment shall be arranged and supported so that vibration is a minimum and is not transmitted to the structure.

1.8 DAMAGES BY LEAKS

- A. The Contractor shall be responsible for damages caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

1.9 EXAMINATION OF SITE

- A. The Contractor shall examine the site, compare it with Plans and Specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.10 COMPATIBILITY WITH EXISTING SYSTEMS

- A. Any work which is done as an addition, expansion or remodel of an existing system shall be compatible with that system.

1.11 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be new unless otherwise noted. Materials and equipment of a given type shall be by the same manufacturer. Materials and equipment shall be free of dents, scratches, marks, shipping tags and all defacing features at time of project acceptance. Materials and equipment shall be covered or otherwise protected during construction as required to maintain the material and equipment in new factory condition until project acceptance. All HVAC equipment and ductwork shall be covered, sealed and protected per CGBSC Section 5.504.3 from delivery on site until final start-up.

1.12 SUBMITTALS

- A. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material or equipment shall not be ordered or installed until written review is processed by the Engineer.

All shop drawings must comply with the following:

1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory. FAX submittals are not acceptable.
2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor, table of contents, and indexed tabs dividing each group of materials or item of equipment. All items shall be identified by the specification paragraph number for which they are proposed. All equipment

shall also be identified by the mark number as indicated on drawings.

3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be high-lighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled or detailed.
 4. Electronic Submittals: Where allowed by Division 01, electronic submittals are acceptable providing the following requirements are met. Electronic submittals which do not comply with these requirements will be rejected.
 - a. Submittal shall be a single file in PDF format, with bookmarks for table of contents and each tab, and sub-bookmarks for each item.
 - b. All text shall be searchable (except text that is part of a graphic).
 - c. Submittal shall include all items noted in 1 through 3 above, except a binder is not required.
 - d. Electronic submittals shall be processed through normal channels. Do not submit directly to the Engineer unless the Engineer is the prime consultant for the project.
 - e. Contractor shall provide Owner and Owner's Representative with hard copies of the final submittal. Coordinate exact number required with Owner through Architect/Engineer.
- B. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and features desired. Proposed substitutions shall comply with the Owner's General Requirements. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items. At the Engineer's request, furnish locations where equipment similar to the substituted equipment is installed and operating along with the user's phone numbers and contact person. Satisfactory operation and service history will be considered in the acceptance or rejection of the proposed substitution.
- C. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and

specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed. If a resubmittal is required, submit a complete copy of the Engineer's review letter requiring such with the resubmittal.

1.13 MANUFACTURER'S RECOMMENDATIONS

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of the particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

1.14 SCHEDULING OF WORK

- A. All work shall be scheduled subject to the review of the Engineer and the Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work, and shall cause no delay to other Contractors engaged upon this project or to the Owner. HVAC equipment and functions, whether existing or new, shall be maintained in operating condition whenever the facility is occupied, unless otherwise approved by the Owner.

1.15 DEMOLITION

- A. Existing equipment, ducts, piping, etc. noted for removal shall be removed and delivered to the Owner at a location to be determined by the Owner. Those items determined by the Owner to be of no value shall become the property of the Contractor and shall be removed from the job site by the Contractor at the Contractor's expense. Existing piping, ducts, services, etc. requiring capping shall be capped below floors, behind walls, above ceilings or above roof unless otherwise noted. Where items are removed, patch the surfaces to match the existing surfaces.

1.16 HAZARDOUS MATERIAL REMOVAL

- A. All hazardous material removal will be by the Owner. Hazardous material is to be removed before the work is started. If the Contractor discovers hazardous material which has not been removed, the Contractor shall immediately cease work in that area and promptly notify the Owner.

1.17 OPENINGS, CUTTING AND PATCHING

- A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. Except as noted below, the actual openings and the required cutting and patching shall be provided by other Divisions. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall be provided by other Divisions. Cutting or

coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

1.18 EXCAVATION AND BACKFILL

- A. General: Barrel of pipe shall have uniform support on sand bed. Sand shall be free from clay or organic material, suitable for the purpose intended and shall be of such size that 90 percent to 100 percent will pass a No. 4 sieve and not more than 5 percent will pass a No. 200 sieve. Unless otherwise noted, minimum earth cover above top of pipe or tubing outside building walls shall be 24", not including base and paving in paved areas.
- B. Excavation: Width of trench at top of pipe shall be minimum of 16", plus the outside diameter of the pipe. Provide all shoring required by site conditions. Where over excavation occurs, provide compacted sand backfill to pipe bottom. Where groundwater is encountered, remove to keep excavation dry, using well points and pumps as required.
- C. Backfill:
 - 1. 6" Below, Around, and to 12" Above Pipe: Material shall be sand. Place carefully around and on top of pipe, taking care not to disturb piping, consolidate with vibrator.
 - 2. One Foot Above Pipe to Grade: Material shall be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to review by Engineer.
- D. Compaction: Compact to density of 95% within building and under walkways, driveways, traffic areas, paved areas, etc. and to 90% elsewhere. Demonstrate proper compaction by testing at top, bottom and one-half of the trench depth. Perform these tests at three locations per 100' of trench.

1.19 CONTINUITY OF SERVICES

- A. Existing services and systems shall be maintained except for short intervals when connections are made. The Contractor shall be responsible for interruptions of services and shall repair damage done to any existing service caused by the work. If utilities not indicated on the drawings are uncovered during excavation, the Contractor shall notify the Engineer immediately.

1.20 PROTECTIVE COATING FOR UNDERGROUND PIPING

- A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru-Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. John-Mansville. Protective coating shall be extended 6" above surrounding grade.

1.21 ACCESS DOORS

- A. Provide access doors as required where equipment, piping, valves, ductwork, etc. are not otherwise accessible. Access doors shall match the wall or ceiling finish and fire rating as indicated on the Architectural drawings. 16-gage steel frame and 14-gage steel door with paintable finish, except in ceramic tile, where door shall be 16-gage stainless steel with satin finish. Continuous hinge. Deliver doors to the General Contractor for installation. Milcor. Unless otherwise noted, the minimum sizes shall be as follows:

| | |
|----------------------|-----------|
| 1 valve up to 1-1/2" | 12" x 12" |
| 1 valve up to 3" | 16" x 16" |

1.22 HOUSEKEEPING PAD

- A. Housekeeping pads shall be 6" high concrete, 3000 PSI strength, unless otherwise noted. Pad shall extend 6" beyond the largest dimensions of the equipment, unless otherwise noted. The top edge of the pad shall have a 3/4" chamfer. Unless otherwise noted, the pad shall have #4 reinforcing bars at 12" on center, each way, located at mid-depth of the pad. If not poured at the same time as the slab with pad rebar tied to slab rebar, the pad shall be anchored as follows: Drill 5/8" diameter, 3" deep hole in slab. Install 7" long, #4 rebar with Simpson Set epoxy system. Provide a minimum of 4 of these anchors per pad, but no more than 4 feet apart in either direction. Anchor points shall be 12" from the edge of the pad.

1.23 CONCRETE ANCHORS

- A. Steel bolt with expansion anchor requiring a drilled hole - powder driven anchors, adhesive anchors and concrete screws are not acceptable. Re-use of screw anchor holes shall not be permitted. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 12 diameters center to center and 6 diameters center to edge of concrete. Post-installed anchors in concrete used for component anchorage shall be pre-qualified for seismic application in accordance with ACI 355.2 and ICC-ES AC193. Post-installed anchors in masonry used for component anchorage shall be pre-qualified for seismic applications in accordance with ICC-ES AC01. Maximum allowable loads for tension and shear shall be as determined by Calculation in compliance with ACI 318-14, Chapter 17, and the anchor's ICC or IAPMO evaluation report. Hilti, Powers, Red Head.

1.24 EQUIPMENT ANCHORING AND OTHER SUPPORTS

- A. Mechanical systems (equipment, ductwork, piping, conduit, etc.) shall be anchored in accordance with the CBC. All systems mounted on concrete shall be secured with a concrete anchor at each mounting point. All air handlers shall be mounted on spring isolators. Secure base plate as indicated above. Attachment of equipment, ductwork, piping, conduit, etc. supported on curbs or platforms shall be made to the side of curbs and platforms, where possible. Where screws or lag bolts must be installed through the top of a sheet metal cap, the installation shall be as follows. Pre-drill pilot hole. Fill pilot hole with polyurethane sealant. Install screw or lag bolt with a flat washer and an EPDM washer adjacent to the sheet metal.

1.25 SUPPORTS AND SEISMIC RESTRAINTS

- A. Any structural element required to hang or support piping, ducts or equipment provided under this Division and not shown on other drawings shall be provided under this Division.
- B. Mechanical systems (equipment, ductwork, piping, etc.) shall be provided with supports and seismic restraints in accordance with the CBC. Submit anchorage calculations and details stamped and signed by a structural engineer registered in the State of California. Submit shop drawings showing location, type and detail of restraints. Submit manufacturer's data for restraints. Restraint system shall be Mason West, Inc. (HCAI OPM 0043-13), or other HCAI preapproved system.

1.26 PAINTING

- A. Paint all black iron supports, hangers, anchors, etc. with two coats of rust resisting primer. Also paint all uninsulated black iron piping exposed to weather with two coats of rust resisting primer.

1.27 ROOF PENETRATIONS AND PATCHING

- A. Whenever any part of the mechanical systems penetrates the roof or exterior wall, the openings shall be flashed and counter-flashed water tight with minimum 22 gauge galvanized sheet metal. Flashing shall extend not less than eight inches from the duct, pipe, or supporting member in all directions unless detailed otherwise. All roof penetrations and patching shall be in accordance with the recommendations of the National Roofing Contractor's Association and the Owner's roofing standards.

1.28 SYSTEM IDENTIFICATION

- A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by pre-printed markers or stenciled marking, and include arrows to show direction of flow. Pre-printed markers shall be the type that wrap completely around the pipe, requiring no other means of fastening such as tape, adhesive, etc. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floors, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portions of lines. Marking of short branches and repetitive branches for equipment connections is not required.
- B. Below Grade Piping: Bury a continuous, pre-printed, bright-colored, metallic ribbon marker capable of being located with a metal detector with each underground pipe. Locate directly over buried pipe, 6" to 8" below finished grade.
- C. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-4) and identifies the area or space served by the equipment. Provide 1/2" high lettering - white on black background. Nameplates shall be permanently secured to the exterior of the unit.

- D. Valves: Provide stamped brass valve tags with brass hooks or chains on all valves of each piping system, excluding check valves, valves within equipment, faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Prepare and submit a tagged-valve schedule, listing each valve by tag number, location and piping service.

1.29 CLEANING

- A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work. This includes but is not limited to building surfaces, piping, equipment and ductwork, inside and out. Surfaces shall be free of dirt, grease, labels, tags, tape, rust, and all foreign material.
- B. At the end of each work day, the Contractor shall cover all open ends of piping and ductwork with protective plastic.

1.30 OPERATION AND MAINTENANCE INSTRUCTIONS

- A. Printed: Three copies of Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts list for all faucets, trim, valves, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-3). All Wiring Diagrams shall agree with reviewed Shop Drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Pumps, Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included.
- B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instructions that apply to the control system. The Engineer's office shall be notified 48 hours prior to this meeting.
- C. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed and verbal) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.31 RECORD DRAWINGS

- A. The Contractor shall obtain one set of prints for the project, upon which a record of all construction changes shall be made. As the work progresses, the Contractor shall maintain a record of all deviations in the work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. building, curbs, walks. In addition, the water, gas, sewer, under floor duct, etc. within the building shall be recorded by offset distances from building walls. An electronic copy of the original drawings will be made available to the Contractor. The Contractor shall transfer the changes, notations, etc. from the marked-up prints to the electronic copy. The record drawings (marked-up prints, electronic drawings disc and a hard copy) shall be

submitted to the Engineer for review.

1.32 ACCEPTANCE TESTING

- A. All acceptance testing as required by California Code of Regulations, Title 24, and as noted on the Certificate of Compliance form, (where applicable), shall be performed and documented by an Acceptance Test Technician (ATT). These documents must be provided to the building inspector during construction and must be completed through an Acceptance Test Technician Certification Provider (ATTCP). The Contractor shall submit a copy of the documentation to the Engineer for review (hardcopy or electronic), prior to submitting to Administrative Authority.

END OF SECTION 20 01 00

SECTION 210000 – FIRE SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 GENERAL PROVISIONS FOR FIRE SPRINKLERS:

- A. The General Mechanical Provisions, Section 20 01 00, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

- A. General: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The entire facility shall be fire sprinklered.
- B. Design/Calculations: The sprinkler system has been designed and sized by hydraulic calculations in accordance with 2016 NFPA No. 13 and fire authority requirements. Calculations have been included in submittals. Provide current fire flow information from flow test at nearest fire hydrant. Fire flow test shall be done within 6 months of installation of sprinkler system.
- C. Preparation of Drawings and Material Data Sheets: A complete fire sprinkler submittal (drawings, specifications, materials and hydraulic calculations) has been prepared. Hydraulic calculations shall conform to 2016 NFPA 13, paragraph 23.3.5 in all respects.
- D. Coordination Drawings: Contractor shall submit coordination drawings (including site) with Contractor title block to Engineer for review, in addition to materials submittals. Deviations between bid documents and coordination drawings shall be specifically noted on drawings (highlighted, clouded, etc.). Any contractor requested design changes to these documents, including layout, materials, or calculations, may be considered a substitution and shall comply with paragraph 1.4 below.

1.3 WORK SPECIFIED ELSEWHERE:

- A. Electrical wiring.
- B. Fire alarm system.

1.4 DESIGN CHANGES/SUBSTITUTIONS:

- A. General: Design changes or substitutions of fire sprinkler system shall be submitted to Engineer for review.
- B. Significant changes in design or substitution of materials may require a change order, requiring resubmission to fire authority, as determined by the Architect, Engineer and/or Inspector. Contractor shall bear all expenses incurred due to preparation and processing of design substitutions, up to and including submission to, and obtaining approval from, fire authority. Refer to Specification Section 20 01 00, 1.12, B.
- C. Any substitution of "Flexible" type piping in lieu of "Rigid" pipe or any changes to

size, manufacturer or lengths of "Flexible" type piping will require resubmittal of piping plans, product data sheets and hydraulic calculations to fire authority for review and approval.

PART 2 - PRODUCTS

2.1 STANDARDS:

- A. All materials shall be in accordance with 2022 NFPA No.13 "Standard for the Installation of Sprinkler Systems". Underground mains shall be in accordance with 2019 NFPA No. 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances".

2.2 PIPING MATERIALS:

- A. General: The pressure rating of all piping, valves, flanges and other piping accessories shall be in accordance with code and fire authority requirements. Pressure ratings shall exceed the highest possible working pressure.
- B. Piping:
 - 1. Underground: Polyvinyl chloride, Class 200, DR 14, AWWA C900, with rubber ring joints, ASTM D1869. Cast or ductile iron fittings, AWWA C110 or C153, Class 250 or higher, with rubber ring joints, ASTM D1869.
 - 2. Above Grade:
 - a. 2" and Smaller: Threaded black steel pipe, ASTM A53, schedule 40. 175 psi WOG (min.) black cast iron threaded fittings, ANSI B16.4, UL listed. Unions shall be Class 150 malleable iron threaded, ANSI B16.3.
 - b. 2-1/2" and Larger: Welded black steel pipe, ASTM A53, schedule 10. Standard weight carbon steel welding fittings, ANSI B16.9. Flanges shall be steel, ANSI B16.5. Roll grooved pipe couplings may be used for assembling welded sections, Victaulic, Grinnell, Gruvlok.
- C. Gate Valve:
 - 1. 2" and Smaller: All bronze, rising stem. UL listed.
 - 2. 2-1/2" and Larger: Iron body, bronze mounted, outside screw and yoke. UL listed. (UL listed butterfly valves may be substituted for 4" and larger gate valves above grade.)
- D. Check Valve:
 - 1. 2" and Smaller: All bronze swing check. UL listed.
 - 2. 2-1/2" and Larger: Iron body, bronze mounted swing check. UL listed.
- E. Drain Valve: All bronze angle globe valve. UL listed.

- F. Anchors and Hangers: Shall comply with 2016 NFPA No. 13.

2.3 SPRINKLER HEAD:

- A. Automatic sprinkler head, concealed type in areas with finished ceilings and recessed or suspended lighting, semi-recessed in areas with finished ceilings and surface lighting, upright or pendent heads elsewhere (as allowed by NFPA 13). Heads in finished areas shall be Victaulic FireLock V38 quick response concealed, Tyco RFI quick response concealed, or Globe Fire Sprinkler Corp., Quick Response GL Series Concealed Pendent, with chrome-finish metal cover plate. Heads elsewhere shall be quick response, Victaulic FireLock V27, Tyco, Model TY-FRB or Globe Fire Sprinkler Corp., Model GL Quick Response, with standard finish. UL listed. Temperature ratings shall be in accordance with NFPA No. 13. Provide extra heads (of each type installed) in accordance with code requirements. Exposed heads installed with deflector lower than 7'-6" above floor shall have wire guards.

2.4 ALARM VALVE ASSEMBLY:

- A. Standard wet type alarm valve assembly complete with trim as required by the authority having jurisdiction. Provide flow switch and Electric Bell for connection to alarm system. Provide tamper switch. UL listed. Coordinate Electric Bell with Division 28.

2.5 POST INDICATOR VALVE:

- A. UL listed valve with lockable operating handle, tamper switch and target visible through a glass covered post, reading either "OPEN" or "SHUT".

PART 3 - EXECUTION

3.1 PIPING INSTALLATION:

- A. General: Piping shall be concealed in walls, above the ceilings or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location shall be approved by the Architect. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. Depth of cover in traffic areas shall be 36 inches (minimum).

1. Installer Certification: Installation shall be performed by certified fire sprinkler fitter(s) as required by CCR, Title 19, Divisions 1, Chapter 5.5. See CAL FIRE – Office of the State Fire Marshall Information Bulletin 17-002 for more information. The Bulletin can be downloaded from the following:
http://osfm.fire.ca.gov/informationbulletin/pdf/2017/IB_AESCert_final_05_25_17.pdf

- B. Standards: All piping shall be installed in accordance with 2022 NFPA No. 13 "Standard for the Installation of Sprinkler Systems". Underground mains shall be installed in accordance with 2019 NFPA No. 24 "Standard for the Installation of

Private Fire Service Mains and Their Appurtenances".

C. Miscellaneous:

1. Escutcheons: Provide chrome plated metal escutcheons where piping penetrates walls, ceilings or floors in finished areas.
2. Pattern: Sprinklers shall be installed in a symmetrical pattern with lighting fixtures and with ceiling pattern. Heads located in lay-in ceilings shall be centered in panel, unless shown otherwise on drawings.
3. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe for piping 3" and smaller and 2" annular clearance for piping 4" and larger.
4. Access: Provide access doors as required for all valves, devices, etc.
5. Pipes Passing through Fire Rated Surfaces: Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe, or pipe insulation sealed with fire rated materials in accordance with the requirements of 2022 CBC Section 714.
6. Concrete Thrust Blocks: Shall be constructed at all valves, tees, elbows, bends, crosses, reducers and dead ends in loose-joint pipe. Blocks shall cure a minimum of 7 days before pressure is applied. Concrete shall be 3000 psi mix.
7. Electrical Equipment: Piping shall not be run over electrical panels, motor control centers or switchboards, except where specifically allowed by CEC.

3.2 IDENTIFICATION:

- A. All controls, piping, valves and equipment shall be labeled for function and service in accordance with 2022 NFPA No. 13 and 2019 NFPA No. 24.

3.3 TESTS AND ADJUSTMENTS:

- A. Unless otherwise directed, tests shall be witnessed by a representative of the Architect and an inspector of the authority having jurisdiction. Contractor shall notify fire authority at least 48 hours prior to testing. At various stages and upon completion, the system must be tested in the presence of the enforcing agency. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and the entire work retested. Test all systems in accordance with fire authority requirements and 2022 NFPA No. 13 and 2019 NFPA No. 24.
- B. Backflow Preventer: All backflow preventers shall be tested according to manufacturer's recommendations and the USC Cross Connection Control and Hydraulic Research Manual (8th Edition). Testing shall be performed by an AWWA Certified Backflow Prevention Assembly Tester. Contractor shall certify in writing to the Architect the date which backflow preventers were tested and by whom test

was witnessed.

3.4 CERTIFICATION:

- A. At completion of the project, a Contractor's Material and Test Certificate, indicating installation and testing in accordance with referenced standards, shall be completed. Copies shall be prepared by Contractor for the approving authorities, Owner and Contractor. Deliver certificates to Owner through Architect.

END OF SECTION 21 00 00

SECTION 220400 – PLUMBING

PART 1 - GENERAL

1.1 GENERAL MECHANICAL PROVISIONS

- A. The General Mechanical Provisions, Section 20 01, 00, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

- A. Included: Provide all labor, materials, and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:
1. Sanitary sewer system.
 2. Domestic water system.
 3. Drain system (including condensate drain).
 4. Storm drain system.
 5. All equipment as shown or noted on the drawings or as specified.
 6. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, braces, housekeeping pads, supports and related items no longer required.
 7. Lead Free: All equipment, fixtures, valves and fixture stops providing water for human consumption installed after January 1, 2010, must meet the "Lead Free" requirements for the State of California.
- B. Work Specified Elsewhere:
1. Line voltage power wiring, disconnect switches and installation of all starters are included in the Electrical Section unless otherwise noted.
 2. Access doors.
 3. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
 4. Painting unless specifically called for in the drawings or specifications.
 5. Carpentry.
 6. Control of circulating pumps, etc.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS:

- A. Sanitary Sewer:
1. Soil, Waste and Vent Piping (Non-Pressurized):
 - a. Inside Building and Within Five Feet of Building Walls: Standard weight coated cast iron pipe and fittings. Plain end, CISPI 301, ASTM A888, or hub end with rubber gaskets, ASTM A74, ASTM C564. ABI, Tyler, Charlotte. Couplings shall be heavy-duty shielded couplings. Type 304 stainless steel, with neoprene gasket, ASTM C1540. Husky HD 2000, Clamp-All 80, Mission HeavyWeight. MG Couplings are also acceptable. 2" and smaller exposed to view shall be galvanized steel, ASTM A53, with coated cast iron recessed drainage fittings, ANSI B16.12.
Where required by soil conditions, as determined by the method described in ASTM A74-09, Appendix X2, below grade cast iron pipe and fittings shall have 8 mil (minimum)

**Polyethylene Encasement (Poly Wrap), Per ANSI/AWWA
C105/A21.5.**

2. Cleanouts: Comparable models of Josam, Wade, Mifab or Zurn are acceptable. Grease plug prior to installation. Floor Cleanouts: Smith 4023 with nickel bronze top in finished areas; Smith 4223 in utility areas. Wall Cleanouts: Smith 4532 with stainless steel cover and screw. Pipe Cleanouts: Iron body with threaded brass plug. Site cleanouts more than 5' outside building may be PVC with PVC plug.
 3. Cleanout Box: Precast reinforced concrete. Cast iron lid marked for service. Christy F8 in foot traffic areas; G5 in roadways. Provide with PVC pipe extension down to top of pipe.
- B. Storm Drain (Including Rain Water Leader, RWL) - Inside Building and Within Five Feet of Building Walls: Same as Soil, Waste and Vent Piping, except as otherwise noted on drawings. Where exposed to view on exterior of building, piping shall be galvanized steel with recessed drainage fittings.
- C. Water:
1. Hot and Cold Water Piping: Materials used in the water system, except valves and similar devices, shall be of like material, except where otherwise approved by Engineer and Authority Having Jurisdiction, prior to start of work.
 - a. Inside Building, Within Five Feet of Building Walls, and All Above Grade:
 - 1) Hard temper seamless copper, ASTM B88. Wrought copper fittings, ANSI B16.22. Type L with brazed joints (1100F, min.). 1-1/2" and smaller above grade may be soldered, lead-free solder. All nipples shall be lead-free red brass (85% copper). Branch piping from the cold water main above the ceiling to roof mounted hose bibbs shall be type "K" copper. Above grade fittings may be copper press fittings, ASME B16.18 or ASME B16.22. EPDM O-rings. Installation shall be in accordance with the manufacturer's installation instructions. ProPress, Apollo, Mueller Streamline.
 2. Valves and Specialties:
 - a. Valves:
 - 1) General: Manufacturer's model numbers are listed to complete description. Equivalent models of Crane, Kitz, Milwaukee, Nibco, Stockham, Walworth or Watts are acceptable. All valves of a particular type or for a particular service shall be by the same manufacturer. Butterfly valves may be substituted for 2-1/2" and larger gate valves above grade; see specification below. Provide a minimum of two operating "T" handles for underground valves for each underground system where valves are required. The lengths of the handles are dependent upon the depth of the valves and the ability of the handles to fully open and/or close the valves. At least one "T" handle for each system shall be on site at the beginning of the installation of a particular system for emergencies, and the

- Construction Manager shall have access to these "T" handles and valves.
- 2) Gate Valve: 2" and Smaller: All bronze. Non-rising stem. Threaded bonnet. Wedge disk. Malleable iron handwheel. 200 psi CWP. Nibco T-113-LF. 2-1/2" and Larger: Iron body, bronze mounted. Non-rising stem. Resilient wedge disk. 200 psi CWP. Flanged or AWWA hub end as applicable. Nibco F-619-RWS. Underground valves shall have square operating nut.
 - 3) Butterfly Valve: Ductile iron threaded lug body. Aluminum bronze disk. EPDM molded-in liner and seals. 416 stainless steel shaft. 6" and smaller valves shall have multi-position lever handle. 8" and larger valves shall have gear operator. Provide 2" extension neck at insulated pipes. Nibco LD-2000.
 - 4) (4) free bronze swing check, regrinding. 200 psi CWP. Nibco T-413-Y-LF. For vertical applications use lead-free bronze, spring-loaded, lift-type. Nibco T-480-Y-LF.
 - 5) Ball Valve: Full port. Lead free brass body, cap, stem, disk and ball. Screwed connection. Lever handle. PTFE seat and stem packing. Min. 400 psi CWP. CSA-US and UL listed. Nibco T-FP-600A-LF.
 - 6) Valve Box: Precast reinforced concrete. Cast iron lid marked for service. Christy F8 in foot traffic areas; G5 in roadways. Provide with PVC pipe extension down to top of pipe.
- b. Instruments:
- 1) Thermometer: 3" dial. Stainless steel case. Back or bottom connected as required. 1/2" NPT. 20F-240F, 2F divisions for hot water. 25F-125F, 2F divisions for chilled water. 2" insertion length. Allowance to be made for insulation thickness. For installations over 7 feet above finish floor, provide digital thermometer with remote reader. Marshalltown, Moeller, Taylor, Tel Tru, Winters.
 - 2) Thermometer Well: Brass well. Suitable for thermometer above. Provide 2" extension at insulated pipes.
- c. Miscellaneous Specialties:
- 1) Temperature and Pressure Relief Valve: ASME rated fully automatic, reseating combination temperature and pressure relief valve sized in accordance with energy input. Sensing element immersed within upper 6" of tank. Watts.
 - 2) Union: 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi. Unions for copper piping shall be copper or lead free cast bronze. Anvil. Size 2-1/2" and Larger: Grooved pipe, synthetic gasket, malleable iron housing. EPDM gasket, NSF 61 rated. Victaulic Style 77, Gruklok.
 - 3) Dielectric Coupling: Insulating union or flange rated for 250 psig. Wilkins DUXL Series.

- 4) Shock Absorber: Multiple bellows. All stainless steel construction. Designed and applied in accordance with PDI WH201. Amtrol, Smith, Wade, Zurn.
- D. Drain Piping (including Condensate): Same as inside building cold water piping.
- E. Miscellaneous Piping Items:
1. Pipe Support:
 - a. Pipe Hanger: Steel "J" hanger with side bolt for piping 4" and smaller; steel clevis hanger for piping 5" and larger. Load and jam nuts. Size and maximum load per manufacturer's recommendation. Felt liner for copper piping. Hanger and rod shall have galvanized finish. B-Line, Anvil, Unistrut.
 - b. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph above. Increase hanger size per manufacturer's recommendation. B-Line, Semco, Superstrut.
 - c. Construction Channel: 12-gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Anvil, Unistrut.
 2. Flashing: Vent flashing shall be 4 lb/ft² lead, 16" sq. flange, length sufficient to be turned down 2" into vent. Oatey. Flashing for other piping through roof shall be prefabricated galvanized steel roof jacks with 16" sq. flange. Provide clamp-on storm collar and seal watertight with mastic. For cold process built-up roof, material shall be 4 lb/ft² lead instead of galvanized steel. For single-ply roofing, use the roofing manufacturer's recommended flashing material.

2.2 PIPING INSULATION MATERIALS:

- A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Pre-Molded Fiberglass: Heavy density sectional pre-molded fiberglass with vapor barrier laminated all service jacket and pressure sealing vapor barrier lap. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft²-F at a mean temperature of 50F. Perm rating 0.02, ASTM E96. Puncture rating 50 Beach units, ASTM D781. Provide 3" (min.) wide tape of same material as lap for butt joints. For hot water piping to 140°F, thickness shall be 1" for pipe sizes less than 1"; 1-1/2" thickness for pipe sizes 1" and 1-1/2"; 2" thickness for 2" and larger. See Title 24, Part 6 "California Energy Code" for temperatures above 140°F. Knauf, Johns-Manville, Owens-Corning.
- C. Fiberglass Blanket: Unfaced. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft²-F at a mean temperature of 50F. 1-1/2" thickness. Knauf, Johns-Manville, Owens-Corning.
- D. PVC Jacket (for pipe, fittings and valves): Pre-molded polyvinyl chloride (PVC) jackets, 0.020" thickness. Size to match application. Provide solvent weld adhesive and PVC vapor barrier pressure sealing tape by same manufacturer. Zeston.
- E. Stretchable Glass Fabric: Reinforcing mesh. 10 x 20 continuous filament glass yarns per inch. Johns-Manville.
- F. Vapor Barrier Coating: Childers CP-30, Foster 30-25.

- G. Lagging Adhesive: Childers CP-50A, Foster 30-36.
- H. Aluminum Jacketing: Aluminum pipe and fitting jacketing. 0.016" thickness for straight pipe. 0.024" thickness for fittings. Stucco-embossed finish. Integral moisture barrier. Provide pre-fabricated aluminum strapping and seals by same manufacturer. Childers.
- I. Outdoor Mastic: Childers CP-10, Foster 65-05.
- J. Insulating Tape: Ground virgin cork and synthetic elastomeric. Black, odorless, and non-toxic. K factor 0.43 Btu-in/hr-ft²-F or less. Non-shrinking. For outdoor use, provide protective finish by same manufacturer. Halstead.
- K. Molded Closed Cell Vinyl (Piping Insulation Under Lavatories and Sinks): Fully molded closed cell vinyl, 1/8" thick, minimum. Thermal conductivity shall not exceed 1.17 BTU-in/hr-ft²-°F at an average temperature of 73°F. Weep hole in cleanout nut enclosure. Hinged cap over valve to allow access for servicing. Out of sight nylon fastening system and internal ribs on drain insulation to provide air gap (Lav-Guard Only). Truebro Lav-guard, McGuire Pro Wrap, Plumberex.

2.3 FIXTURES:

- A. General: Provide rough-in for and install all plumbing fixtures shown on drawings. Except in equipment rooms, all trim, valves, and piping not concealed in wall structure, above ceiling or below floors, shall be brass with polished chrome plate finish, unless noted otherwise. All enameled fixtures shall be acid resisting. Standard color is white unless otherwise noted.
- B. Schedule: Refer to Plumbing Fixture Schedule on the drawings for list of fixtures and trim. Manufacturer's model numbers are listed to complete description. Equivalent models of American Standard, Eljer, Elkay, Haws, Just, Kohler, Moen, T&S Brass, Willoughby or Zurn are acceptable. For drainage fixtures, equivalent models of Josam, Mifab, Smith, Wade or Zurn are acceptable.
- C. Stops and P-Traps: All fixtures shall be provided with stops and P-Traps as applicable. Wall mounted faucets, valves, etc. shall have integral stops or wall mounted stops.
 - 1. Stops: All hot and cold water supplies shall be 1/2" I.P.S. inlet angle stops with stuffing box, loose key lock shield, and brass riser (3/8" for 2-1/2 gpm and less, otherwise 1/2"). 1/4 turn ball stops do not require stuffing box. Dahl, McGuire, Speedway.
 - 2. P-Traps: Semi-cast brass, ground joint. 17-gage. Clean-out plug. Unobstructed waterway. California Tubular, McGuire.
- D. Caulking: Caulk fixtures with white G.E. "Sanitary SCS1700", mildew resistant silicone sealant with EPA listed anti-microbial.

2.4 EQUIPMENT:

- A. General Requirements:
 - 1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
 - 2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all

- proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
3. Ratings -Electrical: Electrical equipment shall be in accordance with NEMA standards and UL or ETL listed where applicable standards have been established.
 4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local
 5. Electrical:
 - a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset and shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
 - b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts, and other devices shall be in ungrounded conductors.
 - c. Motors: Shall be rated, constructed, and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Motors exposed to weather shall be TEFC. Vertical motors with exposed fans shall have rain caps.
 - d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.
 - e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
 - f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.
- B. Water Heater: Electric. Glass lined tank with magnesium anode protection. 150 psi working pressure. Fully insulated. Automatic temperature control. High limit control. Provide ASME rated temperature and pressure relief valve sized in accordance with energy input, dielectric couplings and drain cock. UL listed. A.O. Smith, American Appliance, Bradford-White, Rheem, Ruud, State Industries.
- C. C. Free bronze body, brass impeller. Mechanical seals. Bronze sleeve bearings. Integral thermal overload protection. Bell and Gossett/Xylem, Taco. -OR- Body: Aluminum housing. All parts exposed to fluid, stainless steel. Water lubricated ceramic shaft and bearings. Epoxy encapsulated windings. Grundfos.

- D. Electric Drinking Fountain: Wall hung. Provide steel mounting brackets. Stainless steel basin. Removable grid drain. Chrome plated brass bubbler with automatic flow regulator and self-closing valve. Non-ferrous evaporator. Lead solder shall not be used. Hermetic compressor with automatic reset overload protection. Air cooled condenser. Adjustable thermostat. UL listed. ARI certified. Elkay, Halsey-Taylor, Haws, Sunroc.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION:

A. General:

1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Architect. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Vertical lines shall be installed to allow for building settlement without damage to piping. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted.
2. Joints:
 - a. Threaded: Pipe shall be cut square and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.
 - b. Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100F. Brazing shall be performed by a Certified Brazer as certified by an organization/institution that uses standards recognized by the American Welding Society (AWS) and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.
 - c. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.
 - d. Electrical Equipment: Piping shall not be run over electrical panels, motor control centers or switchboards.
3. Fittings and Valves:
 - a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.
 - b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.
 - c. Unions: A union shall be installed on the leaving side of each valve, at all sides of automatic valves, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.
 - d. Valves: All valves shall be full line size. Provide shut-off valve for each building and each equipment connection. Provide shut-off valve at each point of connection to existing piping. At equipment

- connections, valves shall be full size of upstream piping, except that gas valves within 18" of the point of connection to the equipment may be the same size as the equipment connection.
- e. Valve Accessibility: All valves shall be located so that they are easily accessible. Valves located above ceilings shall be installed within 24" of the ceiling. For situations where this is not practical or where valves are greater than 10' above the floor, chain wheel operators shall be provided. Chain shall extend down to 7' above the floor. All such installations must have prior review by the Engineer.

4. Pipe Support:

- a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam. Vertical piping shall be supported with riser clamp at 20' on center (maximum). Support pipe within 12" of all changes in direction. Support individual pipes with pipe hanger. Copper piping systems which protrude through a surface for connection to a fixture stop or other outlet shall be secured with a drop ell, Nibco 707-3-5, to a Holdrite Model #SB1 bracket; nipple through surface shall be threaded brass.

1) Pressure Pipe:

| Pipe Size (Inches) | Maximum Spacing* Between Supports (ft.) | |
|--------------------|--|---------------|
| | Copper | Sch. 40 steel |
| 1/2 | 6 | 6 |
| 3/4 | 6 | 8 |
| 1 | 6 | 8 |
| 1-1/4 | 6 | 10 |
| 1-1/2 | 6 | 10 |
| 2 | 10 | 10 |
| 2-1/2 | 10 | 10 |
| 3 | 10 | 10 |
| 4 | 10 | 10 |
| 6 | 10 | 10 |

*Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves, or other fittings. Seismic requirements may reduce maximum spacing.

- 2) Gravity Drain Pipe: Piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated above for pressure pipe.
- b. Hot and Cold Water Piping: All hot and cold water piping shall have isolating shield; no portion of this piping shall touch the structure without an isolating shield except at anchor points for fixture rough-in.
- c. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.

5. Miscellaneous:
 - a. Escutcheons: Provide chrome plated metal escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
 - b. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" annular clearance between sleeve and pipe for piping 3" and smaller, otherwise 2" annular clearance. Piping through walls or footings below grade shall be sealed with Link-Seal.
 - c. Pipes Passing through Fire Rated Surfaces: Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe or pipe insulation sealed with fire rated materials in accordance with the requirements of 2022 CBC Section 714.
 - d. Thermometer Gage Tap: Provide tee for instrument well. Minimum size of pipe surrounding well shall be 1-1/2". Mount on side of pipe.
 - e. Dielectric Couplings: Dielectric couplings shall be installed wherever piping of dissimilar metals are joined, except that bronze valves may be installed in ferrous piping without dielectric couplings.
- B. Sanitary Sewer Piping:
 1. General: Where inverts are not indicated, sanitary sewer piping shall be installed at 1/4" per foot pitch. Piping 4" and larger may be installed at 1/8" per foot pitch where structural or other limitations prevent installation at a greater pitch. Bell and spigot piping shall be installed with barrel on sand bed; excavate hole for bell.
 2. Cleanouts: Install cleanouts at ends of lines, at changes of direction greater than 45 degrees, and at not greater than 100 foot intervals. Locate interior cleanouts in accessible locations and bring flush to finished surface.
 3. Vents: Vents shall terminate not less than 6" above the roof nor less than 12" from any vertical surface nor within 10' of any outside air intake. Install horizontal vent lines at 1/4" per foot pitch. Offset vents 2' minimum from gutters, parapets, ridges and roof flashing.
- C. Storm Drain (Including Rain Water Leader, RWL): Similar to Sanitary Sewer. Piping with less than 24" of cover outside building walls shall be cast iron.
- D. Water Piping: Connections to branches and risers shall be made from top of main. Supply header in fixture battery shall be full size to last fixture, reducing in size only on individual connections to each fixture in battery. Minimum pipe size shall be 1/2", unless otherwise noted. Exposed fixture stops and flush valves shall be installed with brass nipples for copper piping and galvanized nipples for galvanized piping. Nipples are to extend from outside of wall to fitting at header or drop behind finish wall surfaces. Pipe nipples shall be same size as stop or flush valve. Provide shut off for each building and each connection to equipment. Shock absorbers shall be installed in a vertical position as indicated on drawings. Only equipment mounted on vibration isolators shall be connected with flexible connections. Underground hot water and cold water piping which run parallel to each other shall be installed a minimum of 3 feet apart.
- E. Drain Piping (Including Condensate): Install with constant pitch to receptacle, 1/4" per foot where possible, otherwise 1/8" per foot minimum. Provide TEE with

clean-out plug at all changes of direction. Provide trap at each air handling unit to prevent air leakage. Only equipment mounted on vibration isolators shall be connected with flexible connection. Piping not concealed in wall structure, above ceilings or below floors shall be chrome plated brass, except in equipment rooms, piping shall be galvanized steel. P&T relief and water heater drain piping shall be galvanized steel. Provide secondary drain piping where required.

3.2 PIPING INSULATION INSTALLATION:

A. Domestic Hot Water:

1. General: All domestic hot water piping, fittings and accessories shall be insulated.
2. Pipe: Apply pre-molded fiberglass sections to pipe using integral pressure sealing lap adhesive in accordance with manufacturer's recommendations. Stagger longitudinal joints. Seal butt joints with factory supplied pressure sealing tape.
3. Fittings and Valves:
 - a. Wrap all fittings and valves with pre-cut fiberglass blanket to thickness matching adjoining insulation. Cover blanket with PVC jacket in accordance with manufacturer's recommendations. Solvent weld. Seal all joints with factory supplied pressure sealing vapor barrier tape with 1-1/2" (min.) overlap on both sides of joint. Insulate valves to stem. Do not insulate unions, flanges or valves unless water temperature exceeds 140F or the piping is exposed to weather.
 - b. For miscellaneous fittings and accessories for which PVC jackets are not available or where proximity of fittings precludes a neat-appearing installation, the Contractor may cover the fiberglass blanket with stretchable glass fabric, one coat of lagging adhesive and a final coat of vapor barrier coating. All exposed ends of insulation shall be adequately sealed.
4. Additional Finish for Exposed Piping and Equipment: All piping and equipment exposed to view but protected from the weather shall be given an additional finish of PVC jackets.

B. Cold Water Piping-Freeze Protection: All cold water piping exposed to weather or other areas subject to freezing (i.e. ventilated attics, uninsulated exterior soffits, etc.) shall be insulated same as hot water piping. Cover with aluminum jacketing where exposed to weather. Short lengths of pipe and valves may be wrapped with insulating tape, 50% overlap. Cover valves to stem. Apply at least two coats of protective finish where exposed to weather.

C. Piping Insulation Under Lavatories and Sinks: Exposed water piping, water stops and drain piping under lavatories and sinks shall be insulated with 1/8" thick molded closed cell vinyl. Installation shall be in accordance with manufacturer's instructions.

3.3 FIXTURE INSTALLATION:

A. Fixture Height: Shall be as indicated on Architectural drawings.

B. Floor Drains or Floor Sinks: Shall be placed parallel to room surfaces, set level, flush with floor, and adjusted to proper height to drain. Cover openings during construction to keep all foreign matter out of drain line.

- C. Wall Hung Fixtures: Shall be provided with proper backing and hanger plates secured to wall. Fixtures mounted on carriers shall bear against stop nuts, clear of wall surface. Caulk fixtures against walls with white G.E. "Sanitary SCS1700" silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).
- D. Floor Mounted Fixtures: Shall be provided with proper support plates. Caulk floor mounted fixtures with white G.E. "Sanitary SCS1700" silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).
- E. Other Connections: Rough-in and connection for trim or fixtures supplied by others shall be included in this specification section.

3.4 EQUIPMENT INSTALLATION:

- A. General: It shall be the responsibility of the equipment installer to insure that no work done under other specification sections shall in any way block, or otherwise hinder the equipment. All equipment shall be securely anchored in place.
- B. Connections to Equipment: Where size changes are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.

3.5 TESTS AND ADJUSTMENTS:

- A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Architect. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test, and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections, however, all connections between sections previously tested and new section shall be included in the new test.
- B. Gravity Systems:
 - 1. Sanitary Sewer: All ends of the sanitary sewer system shall be capped and lines filled with water to the top of the highest vent, 10' above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.
 - 2. Drains (Including Condensate): Similar to Sanitary Sewer.
- C. Pressure Systems:
 - 1. General: There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made.
 - 2. Domestic Hot and Cold Water Piping: Maintain 100 psig water pressure for 4 hours.
 - 3. Storm Drain: Similar to Sanitary Sewer.
- D. Fixtures: Provide torque testing of water closet carrier anchor bolts in presence of Inspector. If Inspector is not available, a testing agency shall handle the inspection.

3.6 DISINFECTION:

- A. Disinfect all domestic water piping in accordance with 2016 CPC Section 609.9, and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and witnessed by a representative of the Architect. During procedure signs shall be posted at each

water outlet stating, "Chlorination - Do Not Drink". After disinfection, one set of water samples shall be collected by Contractor for bacteriological analysis in presence of Inspector. If the water fails the bacteriological test, Contractor shall disinfect the piping again and pay for any retesting required, at no additional cost to owner. Bacteriological testing results shall be obtained by Contractor and delivered to the Owner through the Architect before project completion. Contractor shall include copy of Bacteriological Test Results at closeout with operation and maintenance manuals.

END OF SECTION

SECTION 230800 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

PART 1 - GENERAL

1.1 GENERAL MECHANICAL PROVISIONS

- A. The General Mechanical Provisions, Section 20 01 00, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE

- A. Included: Provide all labor, materials and services necessary for complete, lawful and operating systems as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:

1. Air distribution system.
2. All equipment as shown or noted on the drawings or as specified.
3. Refrigeration system.
4. System energy balance.
5. Coordinate with Section 25 09 00 (Direct Digital Control System) regarding location and installation of system sensors, valves, actuators, etc. and to provide simultaneous start-up.
6. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, ductwork, braces, supports, housekeeping pads, temperature controls and related items no longer required.

- B. Work Specified Elsewhere:

1. Line voltage power wiring to equipment, motor starters in motor control centers, disconnect switches and installation of all starters are included in the Electrical Sections, unless otherwise noted.
2. Connection of condensate drains and domestic water to equipment.
3. Access doors.
4. Concrete and reinforcing steel unless specifically called for in the drawings or specifications.
5. Painting unless specifically called for in the drawings or specifications.
6. Carpentry.
7. Direct Digital Control System.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refrigerant Piping: Hard drawn Type ACR copper, dried and capped, ASTM B280. Wrought copper fittings, silver alloy brazed, 1100°F, Silfos.

- B. Miscellaneous Piping Items:

1. Pipe Support:
 - a. Pipe Hanger: Steel "J" hanger with side bolt for piping 4" and smaller; steel clevis hanger for piping 5" and larger. Load and jam

- nuts. Size and maximum load per manufacturer's recommendations. Felt liner for copper piping. Hanger and rod shall have galvanized finish. B-Line, Unistrut.
- b. Isolating Shield: Galvanized steel shell and reinforcing ribs. 1/4" non-conducting hair felt pad. Pipe hanger in accordance with paragraph above. Increase hanger size per manufacturer's recommendation. B-Line, Semco.
 - c. Construction Channel: 12-gage, 1-5/8" x 1-5/8" galvanized steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Unistrut.
2. Flashing: Flashing for piping through roof shall be prefabricated galvanized steel roof jacks with 16" square flange around pipe. Provide clamp-on storm collar and seal water tight with mastic. Maintain dielectric separation between copper and galvanized materials. For cold process built-up roof, material shall be 4 lb/ft² lead instead of galvanized steel.

2.2 PIPING INSULATION MATERIALS

- A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. PVC Jacket (for pipe, fittings and valves): Pre-molded polyvinyl chloride (PVC) jackets, 0.020" thickness. Size to match application. Provide solvent weld adhesive and PVC vapor barrier pressure sealing tape by same manufacturer. Zeston.
- C. Aluminum Jacketing: Aluminum pipe and fitting jacketing, 0.016" thickness for straight pipe. 0.024" thickness for fittings. Integral moisture barrier. Stucco-Embossed finish. Provide pre-fabricated aluminum strapping and seals by same manufacturer. ITW or RPR.
- D. Metal Jacketing Sealant: Childers CP-76, Foster 95-44.
- E. Flexible Elastomeric: Closed cell flexible elastomeric preformed pipe insulation. Thermal conductivity shall not exceed 0.27 Btu-in/hr-ft²-°F at a mean temperature of 70°F. 1/2" thick. Provide #520 adhesive and Armaflex insulation pipe hangers by same manufacturer. Armacell Armaflex.

2.3 DUCTWORK MATERIALS:

- A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50. Shall comply with 2022 CMC.
- B. Metal Ductwork: Metal ductwork shall be galvanized sheet steel, lock forming quality, ASTM A-653, with gage and construction to match SMACNA Standard for pressure required (26 gage minimum).

- C. Flexible Ductwork: Insulated flexible ductwork. One pound per cubic foot glass fiber insulation, 1-1/2" thick (R-6), 2" thick (R-8) where ductwork is outside the building thermal insulation envelope. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft²-°F at a mean temperature of 75°F. Seamless metalized reinforced polyester vapor barrier jacket. Duct shall comply with NFPA 90A. Continuous internal liner bonded to galvanized steel wire helix. Duct shall be capable of continuous operation at 1-1/2" of positive water static pressure and 4,000 ft/min air velocity. JP Lamborn.
- D. Duct Sealants: All Joints Exposed to Weather: Sealant shall be water based, Foster 32-19/32-17, Childers CP-146/148, United Duct Sealer WB or G.E. "SilPruf" SCS2000 silicone sealant. Joints Not Exposed to Weather: Fiber reinforced. White in color. Foster 32-17, Childers CP-148, Design Polymerics DP1030, Hardcast Versa-Grip 181, Hardcast CCWI-181.

2.4 AIR TERMINALS AND DUCT FITTINGS:

- A. Grilles: (Grilles, Registers, Diffusers and Louvers)
 - 1. Information on Drawings: Refer to Grille Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description Titus. Equivalent models of Anemostat or Krueger are acceptable. Refer to the floor plans for neck size, CFM, air diffusion pattern and fire damper, if required.
 - 2. Performance: Submit complete performance data (throw, pressure drop, noise level, etc.) for all grilles proposed, other than those scheduled. Testing shall be in accordance with ANSI/ASHRAE 70-1991. If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be reselected by the Contractor for the proper diffusion, spread, pressure drop, throw and noise level.
 - 3. Frame and Accessories: Supply, return, and exhaust grilles shall not have an opposed blade volume control damper unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawings. Key or screwdriver operated, no slide bars.
 - 4. Finish: All ceiling and wall grilles and all louvers shall have a paintable white finish unless otherwise noted. Interior components (everything behind the face plate) shall be flat black. Floor grilles shall have an anodized aluminum finish unless otherwise noted.
- B. Branch Duct Volume Damper: Volume control damper (VCD) in rectangular ducts shall be as follows: Opposed blade, 6" maximum blade width, 16-gage blade, 48" maximum length, nylon or oil impregnated bronze bearings, 1/2" diameter pin shaft, 16-gage channel frame, actuating rod and linkage out of air stream. VCD in round duct shall be as follows: Damper blade full height of branch and 1" less than branch width. All branch dampers shall have regulator with stamped steel handle, spring loaded shaft nut, cast body and serrated self-locking die cast core.

Regulator for horizontal ducts overhead shall be mounted on sides or bottom of ducts. Secure a 12" length of brightly colored plastic ribbon to handle for ease of location. Where rectangular or round ductwork is insulated, slit insulation to allow handle to protrude. Ventlok 641 (with 607 end bearing for round ducts).

- C. Extractor: Curved blade turns in adjustable position rigid frame. Tuttle and Bailey Deflectrol.
- D. Turning Vanes: Double wall, hollow metal, air foil shape. Spacing in accordance with manufacturer's recommendations. Aero Dyne HEP.
- E. Flexible Connection: UL listed neoprene coated 30 ounce fiberglass cloth. 3" metal, 3" fabric, 3" metal. Ventglas.

2.5 DUCTWORK INSULATION MATERIALS:

- A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Fiberglass Blanket: **Installed** thermal resistance at a mean temperature of 75°F shall meet or exceed indicated value. 3/4 lb/ft³ or 1 lb/ft³, **R-6** where ductwork is within the building thermal insulation envelope. 3/4 lb/ft³ **R-8** where ductwork is outside the building thermal insulation envelope and/or above the roof. Faced with glass reinforced foil laminated to Kraft paper. Certainteed, Knauf, Johns-Manville, Owens-Corning.
- C. Acoustic Lining: Glass fiber. **Installed** thermal resistance at a mean temperature of 75°F shall meet or exceed indicated value. One side coated to prevent fiber erosion up to 6000 ft/min. Average noise reduction coefficient of 0.80. 1.5 lb/ft³ density. 1" thick (**R-4.2**) where ductwork is within the building thermal insulation envelope. 2" thick (**R-8**) where ductwork is outside the building thermal insulation envelope and/or above the roof. Certainteed, Knauf, Johns-Manville, Owens-Corning.
- D. Bonding Adhesive: Design Polymerics DP2501, Foster 85-60.

2.6 EQUIPMENT

- A. General Requirements:
 - 1. Start-up: All equipment shall be started and tested in accordance with the manufacturer's written instructions. Start-up procedure shall be performed by a factory trained service technician – not the installing contractor. Provide the inspector of record with factory start-up literature for each mechanical equipment item. Demonstrate to inspector that the start-up procedure has been completed. Start-up sheets shall be completed and submitted with O&M manuals. Start-up sheets shall be submitted, certifying that start-up has been completed per manufacturer's written instructions.
 - 2. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.

3. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
4. Ratings: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.
5. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. For equipment mounted on springs, provide flex connections. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
6. Electrical:
 - a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be NEMA rated, manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
 - b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts and other devices shall be in ungrounded conductors.
 - c. Motors: Shall be rated, constructed and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Motors 1 HP and above shall be NEMA premium efficiency, Class F insulation. Motors in a fan air stream shall be TEFC or TEAO. Vertical motors exposed to weather shall be TEFC and shall have rain caps. Horizontal motors exposed to weather shall be TEFC. Motors for use with VFD's shall be inverter ready.

- d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.
 - e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
 - f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.
7. Fan Selection:
- a. Fan Curves: Performance curves shall be submitted for all units of 3000 CFM or greater. Operating point for forward curved fans shall be from point of maximum efficiency toward increased CFM limited by horsepower scheduled. Operating point for backward inclined fans shall be selected near point of maximum efficiency. Curves shall plot CFM verses static pressure with constant brake horsepower, RPM and efficiency lines.
 - b. Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure includes all ductwork, filter, coil, cabinet, damper and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.3" WC, unless otherwise noted. Submit itemized static pressure losses for all components.
8. Filters:
- a. General: Tested and rated in accordance with ASHRAE Standard 52.2 and Title 24, C.C.R. Furnish and install one complete change of all filters after air balance is completed and prior to acceptance.
 - b. Filter Media: 2" media. MERV-13. Clean filter resistance 0.41" water at 500 fpm. Throw-away frame. Class 2. Camfil AP-Thirteen.
9. Screens: All duct or louver openings to the outside shall be covered with 1/2", 16-gage, galvanized wire mesh screen.
10. Mixing Dampers: Opposed blade, 16 gage. Six inch maximum blade width, 48" maximum length. Nylon or oil impregnated bronze bearings. One half inch diameter pin shaft. 16 gage channel frame. One percent maximum leakage at 4" WC in accordance with AMCA 500 for outside air dampers. Actuating rod out of air stream. Arrow.

11. Sound Ratings: Shall be in accordance with ASHRAE 36 - 72. Sound ratings shall not exceed scheduled values.
12. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/- 10%, selected at mid range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.

B. Split System Heat Pump System:

1. General: Variable capacity, heat pump air conditioning system providing simultaneous cooling and heating. Refer to Paragraph 2.6A for general requirements. The system shall consist of an outdoor unit, indoor units and M-NET DDC (Direct Digital Controls). System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. Each indoor unit or group of indoor units shall be independently controlled. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of outdoor rated capacity. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit. The units shall be covered by the manufacturer's limited warranty for a period of one (1) year from date of installation. In addition the compressor shall have a manufacturer's limited warranty for a period of seven (7) years from date of installation. The mandatory contractor service and install training shall be performed by the manufacturer. Trane-Mitsubishi.
2. Outdoor Units (ODU):
 - a. General: The outdoor unit shall be used specifically with compatible components. The outdoor units shall be equipped with multiple circuit boards that interface to the M-NET controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.
 - (1) All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor.
 - (2) Outdoor unit shall have a sound rating no higher than 60 dB(A) individually or 64 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 53 dB(A) twinned while in night mode operation. If an alternate manufacturer is selected, any additional material, cost, and

labor to meet published sound levels shall be incurred by the contractor.

- (3) Both refrigerant lines from the outdoor unit to the indoor unit(s) shall be insulated.
- (4) The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
- (5) The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.
- (6) The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet and have total refrigerant tubing length of 1804-2625 feet. The greatest length is not to exceed 541 feet between outdoor unit and the indoor units without the need for line size changes or traps.
- (7) The outdoor unit shall be capable of operating in heating mode down to -4°F ambient temperature or cooling mode down to 23°F ambient temperature, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.
- (8) The outdoor unit shall be capable of operating in cooling mode down to -10°F with optional manufacturer supplied low ambient kit.
- (9) Manufacturer supplied low ambient kit shall be provided with predesigned control box rated for outdoor installation and capable of controlling kit operation automatically in all outdoor unit operation modes.
- (10) Manufacturer supplied low ambient kit shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
- (11) Manufacturer supplied low ambient kit shall be factory tested in low ambient temperature chamber to ensure operation. Factory performance testing data shall be available when requested.
- (12) The outdoor unit shall not cease operation in any mode based solely on outdoor ambient temperature.
- (13) The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

- (14) Unit must defrost all circuits simultaneously in order to resume full heating more quickly. Partial defrost which may extend "no or reduced heating" periods shall not be allowed.
- b. Unit Cabinet: The casing(s) shall be fabricated of galvanized steel, bonderized and finished. Units cabinets shall be able to withstand 960 hours per ASTM B117 criteria for seacoast protected models (-BS models)
- c. Fan:
 - (1) Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan. The fan shall be factory set for operation under 0 in. WG external static pressure, but capable of normal operation under a maximum of 0.24 in. WG external static pressure via dipswitch.
 - (2) All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
 - (3) All fan motors shall be mounted for quiet operation.
 - (4) All fans shall be provided with a raised guard to prevent contact with moving parts.
 - (5) The outdoor unit shall have vertical discharge airflow.
- d. Refrigerant: R410A.
- e. Coil:
 - (1) The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
 - (2) The coil fins shall have a factory applied corrosion resistant blue-fin finish.
 - (3) The coil shall be protected with an integral metal guard.
 - (4) Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
 - (5) The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.
- f. Compressor:
 - (1) Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors shall not be allowed.

- (2) A crankcase heater(s) shall be factory mounted on the compressor(s).
- (3) The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 19%-5% of rated capacity, depending upon unit size.
- (4) The compressor will be equipped with an internal thermal overload.
- (5) The compressor shall be mounted to avoid the transmission of vibration.
- (6) Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

g. Electrical:

- (1) The outdoor unit electrical power shall be 208/230 or 460 volts, 3-phase, 60 hertz.
- (2) The outdoor unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz), 207-253V (230V/60Hz) or 414-506V (460V/60Hz).
- (3) The outdoor unit shall be controlled by integral microprocessors.
- (4) The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

3. Indoor Units (IDU):

- a. General: The TPEFY shall be a ceiling-concealed ducted indoor fan coil design that mounts above the ceiling with a 2-position, field adjustable return and a fixed horizontal discharge supply and shall have a modulating linear expansion device. The TPEFY shall support individual control using M-NET DDC controllers.
- b. Indoor Unit. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

c. Unit Cabinet:

- (1) The unit shall be, ceiling-concealed, ducted.
- (2) The cabinet panel shall have provisions for a field installed filtered outside air intake.

d. Fan:

- (1) TPEFY models shall feature external static pressure settings from 0.14 to 0.60 in. WG.
- (2) The indoor unit fan shall be an assembly with one or two Sirocco fan(s) direct driven by a single motor.
- (3) The indoor fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
- (4) The indoor fan shall consist of three (3) speeds, High, Mid, and Low plus the Auto-Fan function
- (5) The indoor unit shall have a ducted air outlet system and ducted return air system.

e. Filter:

- (1) Return air shall be filtered by means of a standard factory installed return air filter.
- (2) Optional return filter box (rear or bottom placement) with high-efficiency filter shall be available for all TPEFY indoor units.

f. Coil:

- (1) The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
- (2) The tubing shall have inner grooves for high efficiency heat exchange.
- (3) All tube joints shall be brazed with phos-copper or silver alloy.
- (4) The coils shall be pressure tested at the factory.
- (5) A condensate pan and drain shall be provided under the coil.
- (6) The condensate shall be gravity drained from the fan coil.

- (7) Both refrigerant lines to the TPEFY indoor units shall be insulated.

g. Electrical:

- (1) The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
- (2) The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

h. Controls:

- (1) This unit shall use controls provided by Trane-Mitsubishi Electric Cooling & Heating to perform functions necessary to operate the system.
- (2) Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
- (3) Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
- (4) Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
- (5) Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.
- (6) Manufacturer to provide drain pan level sensor powered by a 20-year life lithium battery. Sensor shall require no external power for operation and shall have an audible indication of low battery condition.
- (7) The drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur the control shuts down the indoor unit before an overflow can occur. A thermistor error code will be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.

C. Exhaust Fan:

1. General: All exhaust fans shall be tested according to AMCA Standard 210 in an AMCA registered laboratory. Fans exposed to weather shall have

ventilated weatherproof housing over motor and drive assembly. Refer to Paragraph 2 06A for general requirements. All direct drive fans shall be provided with unit mounted speed controllers, unless otherwise noted. All motors 1 horsepower and larger shall be the premium efficiency type.

2. Ceiling Fan: Direct driven, centrifugal exhaust fan. Fan wheel housing and integral outlet duct shall be galvanized steel or injection molded from a specially engineered resin exceeding UL requirements for smoke and heat generation. Outlet duct shall have an aluminum backdraft damper with continuous aluminum hinge rod. Inlet box shall be minimum 22 gauge galvanized steel. Motor shall be isolation mounted to a one piece galvanized stamped steel integral motor mount/inlet. Provide a field wiring compartment with disconnect receptacle. Provide an adjustable prepunched mounting bracket to accommodate different ceiling thickness. Provide a powder painted white aluminum egg-crate grille. Unit shall be designed with provision for field conversion from ceiling to in-line. Wheel shall be centrifugal forward curved type, galvanized steel or injection molded of polypropylene resin. Motor shall be open drip proof type with permanently lubricated sealed bearings and include impedance or thermal overload protection and disconnect plug. Greenheck.
3. Square Inline Fan: Fan shall be duct mounted, direct driven centrifugal square inline. Fan shall bear the AMCA certified ratings seal for sound and air performance. Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. Housing shall be minimum 18-gauge steel with airflow straightening vanes and integral duct flanges. Hinged access door shall be located in the specified position. Unit shall bear an engraved aluminum nameplate. All steel fan components shall be coated with an electrostatically applied, baked polyester powder coating. Each component shall be subject to a five stage environmentally friendly wash system, followed by a minimum 2 mil thick baked powder finish. Paint must exceed 1,000 hour salt spray under ASTM B117 test method. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone. Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure. Greenheck.

PART 2 - EXECUTION

3.1 PIPING INSTALLATION

A. General:

1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Engineer. No structural member shall be weakened by cutting, notching, boring or otherwise, unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete

drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Vertical lines shall be installed to allow for building settlement without damage to piping. Lines shall be adequately braced against vertical and lateral movement. For piping connected to equipment mounted on springs, provide flex connections. Pipe sizes indicated on the drawings are nominal sizes unless otherwise noted. Pipe sizes shall not decrease in direction of flow, unless otherwise noted.

2. Joints:

- a. Threaded: Pipe shall be cut square, and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.
- b. Brazed: Welding and brazing shall conform to American Welding Society (AWS) standards. Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100°F. Brazing shall be performed by a Certified Brazer as certified by an organization/institution that uses standards recognized by the AWS and meets the requirements of the ASME Boiler and Pressure Vessels Code, Section 9. The Contractor shall submit welding procedures per AWS for project welds for testing lab review.
- c. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.

3. Fittings and Valves:

- a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.
- b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.

4. Pipe Support:

- a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below (based on straight lengths of pipe with couplings only). Provide additional supports for equipment, valves or other fittings. Seismic requirements may reduce maximum spacing. Actual spacing requirements will depend on structural system. Refer to drawings for additional requirements and attachment to structure. Side beam clamps shall be provided with retaining straps to secure the clamp to the opposite side of the beam. Vertical piping shall be supported with riser clamp at 20' on center (maximum). Support pipe within 12" of all changes in direction.

- b. Refrigerant Piping: Support insulated refrigerant line with construction channel and sheet metal support saddle or Cooper B-Line Armafix clamps. 5' spacing. Use isolation shield for uninsulated pipe. When using pre-charged tubing, all changes of direction shall be made with bending tools producing neat uniform bends. Free hand bends will not be accepted.
 - c. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for review.
5. Miscellaneous:
- a. Escutcheons: Provide chrome plated metal escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
 - b. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" (nominal) clearance between sleeve and pipe or pipe insulation.
 - c. Pipes Passing through Fire Rated Surfaces: Pipes passing through fire rated walls, floors, ceilings, partitions, etc. shall have the annular space surrounding the pipe or pipe insulation sealed with fire rated materials in accordance with the requirements of 2022 CBC Section 714.
- B. Refrigerant Piping: Pipe shall be cut square. Joint surfaces shall be thoroughly cleaned, fitted and erected before brazing. After installation, evacuate to 29 inches of mercury, ambient temperature during evacuation shall not be less than 70°F. After evacuation, fill with dry nitrogen to 250 psi and maintain for two hour period without additional charge. After nitrogen test, purge with refrigerant charged through dryer and maintain holding charge in system and equipment. Refrigerant piping below grade shall be run in 4" (min.) PVC conduit with long radius ells. Seal ends of conduit watertight.

3.2 PIPING INSULATION INSTALLATION

- A. Refrigerant Piping: Cover piping with foamed plastic insulation. Longitudinal and end seams shall be thoroughly cemented with adhesive in accordance with manufacturer's recommendations. Cover all fittings, unions, valves and connections. Piping exposed to view shall be covered with PVC jacketing. Piping exposed to weather shall be covered with aluminum jacketing, install all joints and seams to prevent water entry, seal with 1/8" bead of gray metal jacketing sealant.

3.3 DUCTWORK INSTALLATION:

- A. General:
- 1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA Standards. Ductwork shall be built to a pressure classification equal to or greater than the maximum operating pressure at that point in the ductwork. A copy of these standards

shall be maintained at the job site at all times. Duct work and accessories shall be installed in a manner to prevent vibration and rattling.

2. Access: Provide duct access doors as required to adjust equipment and dampers. Provide wall or ceiling access panels, or remote actuators as required where equipment and dampers are not otherwise accessible. Ventlok 666 concealed remote actuator with zinc finish on cover.
 3. Flexible Connections: Connection of ductwork to any vibrating equipment shall be with 3" (min.) flexible connection. Install with ample slack and uniform gap. There shall be no metal to metal contact across flexible connection. Flexible connections exposed to weather shall have a protective sheet metal cover.
 4. Flanges and Escutcheon: Where ductwork penetrates walls, ceilings, or floors, furnish and install flange or escutcheon of same material as duct.
- B. Low Velocity-Low Pressure (up to 2,000 ft/min and up to 2.0 in water):
1. Sheet Metal Ductwork:
 - a. Ells: Ells with less than standard radius and square ells shall be fitted with turning vanes.
 - b. Tees: Tees in supply ductwork shall be straight tap-in with extractor or 45 degree take-off as shown on drawings. Grilles or branches in supply ductwork shall be a minimum of 8 duct diameters downstream of tees.
 - c. Duct Joints and Seams: All joints and seams which are not exposed to weather shall be sealed airtight with duct sealant. All joints and seams exposed to weather shall be sealed air and water tight with silicone sealant. (See Part 2 of this Specification).
 - d. Dampers: Install volume control damper and damper regulator in all branch ducts.
 2. Flexible Glass Fiber Ductwork: The use of flexible duct is limited to the last 5 feet of each branch duct (i.e. one 5 foot section of flexible duct may be used to connect the grille to the sheet metal branch duct). No joints are permitted in this 5' length. Hangers shall be 4" wide metal straps spaced to prevent sagging, 42" spacing maximum. Insert 6" wide fiberglass pad between duct and hanging strap. Joints shall be installed with stainless steel or nylon draw bands, Duro Dyne Dyn-O-Tie. Minimum turn radius of duct centerline not less than 1.5 times the duct diameter. Install without excess length. Ducts shall not be compressed.

3.4 AIR TERMINALS AND DUCT FITTINGS INSTALLATION:

- A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA Standards. Terminals and fittings shall be

installed in a manner to prevent vibration and rattling. Metal surfaces exposed to view behind grilles and registers shall be painted flat black.

3.5 DUCTWORK INSULATION INSTALLATION:

- A. General: Insulate all sheet metal supply, return and outside air intake ductwork except as noted below. Insulation shall be continuous through walls and floors except at fire dampers.
- B. Where Insulation Is Not Required: Do not insulate factory-insulated ducts or casings, acoustic lined ducts, fibrous glass ducts, underground ductwork, supply or return ductwork exposed to view in the space that it serves, or exhaust ductwork.
- C. Concealed Ductwork: Wrap concealed ductwork including outside air intakes with fiberglass blanket lapped 2" minimum. Secure with staples 4" on centers maximum on straight runs and 3" maximum at elbows and fittings. Insulation on bottom of ducts wider than 36" shall also be secured with mechanical fasteners at 24" on center.
- D. Acoustic Lining: Unless otherwise indicated, all supply and return ductwork in equipment rooms, all ductwork exposed to weather and other ducts as indicated on drawings, shall have acoustic lining. Do not acoustic line outside air intakes. Where acoustic lining is installed, increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and also secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.

3.6 EQUIPMENT INSTALLATION

- A. General: The equipment installer shall ensure that no work done under other specification sections will in any way block or hinder the equipment. All equipment shall be securely anchored in place. Provide factory start-up for all equipment in the Central Plant.
- B. Connections to Equipment: Where size changes are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.

3.7 TESTS AND ADJUSTMENTS

- A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Engineer. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair all work to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested.

3.8 SYSTEM ENERGY BALANCE

- A. Scope: Provide the services of an independent test and balance agency to test, adjust and balance, retest and record performance of the system to obtain design quantities as specified. The agency must prove that they have no affiliation with

any equipment manufacturer, design engineer, installing contractor, or any other party which might lead to a conflict of interest, in order to provide an unbiased, third party system balance and report.

- B. Qualifications: Prior to commencing work, the agency shall be reviewed by the Engineer and shall be certified by the Associated Air Balance Council or National Environmental Balancing Bureau. The agency shall provide documentation of having successfully completed at least five projects of similar size and scope. The Contractor must have sufficient personnel to respond to a trouble call at the site within two hours.
- C. Instruments: All instruments shall be accurately calibrated; calibration histories shall be available for examination. Application of instrumentation shall be in accordance with AABC or NEBB standards.
- D. Submittals: Include in shop drawings copies of forms to be used for testing and balancing showing all data which is to be recorded. Three copies of completed balance report shall be submitted for review.
- E. Procedure - General: Procedure shall be in accordance with Associated Air Balance Council's "National Standards for Field Measurements and Instrumentation - Total System Balance", Volume Two, No. 12173, or equivalent NEBB standards. System shall be in full, continuous operation during test. Balanced quantities shall be plus 10%, minus 0% of design quantities. All nameplate data, manufacturer, model and serial numbers shall be recorded for each item tested.
- F. Extended Warranty: The test and balance agency shall include an extended warranty of 90 days after completion of test and balance work, during which time the Engineer, at his discretion, may request a recheck or resetting of any item or items in test report. The agency shall provide technicians to assist the Engineer in making any tests he may require during this period of time.
- G. Air Balance Procedure (For Each Air Handling System):
 - 1. All air filters shall be clean when air balance is performed.
 - 2. Provide a sketch of the equipment showing exactly where all pressure readings were taken.
 - 3. Adjust blower RPM to design requirements.
 - 4. Record motor full load amperes.
 - 5. Make pitot tube traverse of main supply and return ducts and obtain design CFM at fans.
 - 6. Record system static pressures, inlet and discharge.
 - 7. Record filter quantity, size(s) and pressure drop across filter(s) at each filter bank.

8. Adjust system for design CFM recirculated air.
9. Adjust system for design CFM outside air.
10. Record entering air temperatures. (DB heating, DB and WB cooling.)
11. Record leaving air temperatures. (DB heating, DB and WB cooling.)
12. Adjust all main supply and return air ducts to design CFM.
13. Adjust all zones to design CFM, supply and return.
14. Adjust all diffusers, grilles and registers to plus 10%, minus 0% of design requirements.
15. Adjust CFM at all exhaust fans, make-up units, etc. (high and low speed, where applicable). Record applicable data from items 1 through 11 above.
16. Each grille, diffuser and register shall be identified as to location.
17. Verify proper diffusion pattern for all ceiling grilles and that all sidewall grilles are set for 5 degrees upward deflection unless otherwise noted. Make a notation of any that are not set properly.
18. Size, type and manufacturer of diffusers, grilles, registers and all tested items shall be identified and listed. Manufacturer's ratings shall be used to make required calculations on all items.
19. Readings and tests of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
20. In cooperation with the control manufacturer's representative, set adjustments of automatically operated dampers to operate as specified. Testing agency shall check all controls for proper calibrations and list all controls requiring adjustment by control installers.
21. All diffusers, grilles and registers shall be adjusted for required air patterns and to minimize drafts.
22. As a part of the work of this contract, THE AIR CONDITIONING CONTRACTOR shall make any changes in pulleys, belts and dampers or the addition of dampers required for correct balance as recommended by air balance agency, at no additional cost to Owner.
23. Set, test and adjust packaged heating/cooling unit economizer operation in cooperation with controls contractor. Record minimum and maximum outside and exhaust airflows.
24. Verify that the controls contractor has commissioned and documented their work before the TAB work begins

SECTION 050900 - DIRECT DIGITAL CONTROL SYSTEM

PART 1 - GENERAL

1.1 GENERAL MECHANICAL PROVISIONS

- A. The General Mechanical Provisions, Section 20 01 00, shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE

- A. Included: Provide all labor, materials, and services necessary for a complete, lawful and operating direct digital control (DDC) system as shown or noted on the drawings or as specified here. The work includes, but is not necessarily limited to, the following:
1. Control panels, control devices, line and low voltage wiring, conduit and related equipment as required for proper operation of all controlled systems.
 2. Power wiring required for control devices such as actuators, controllers, sensors, and power supplies. Power wiring for these devices shall be fed from circuits dedicated to the DDC system.
 3. provide access to hardware and software or onsite technical support required to assist the TAB effort. The hardware and software or the onsite technical support shall be provided at no cost to the TAB Firm.
- B. Work Specified Elsewhere:
1. Line voltage dedicated power circuits for stand-alone building controllers are included in the Electrical Divisions unless otherwise noted.

1.3 CONTRACTOR QUALIFICATIONS

- A. All controls shall be furnished and installed by a Contractor who is licensed, certified, or contracted by the controls manufacturer for design, installation, start-up and service of their product. The Contractor must have factory supplied training and support. The Contractor shall have sufficient personnel to respond to a trouble call at the site within four hours. The Contractor's local manager shall have a minimum of five years' experience in the design, installation, start-up and service of similar systems. The Contractor shall submit a list of at least five projects which are similar in size, scope and contract value to this project. This list shall include the Owner's contact person, phone number and controls contract value.
- B. Quality Assurance
1. General
 - a. The Building Management System (BMS) Contractor shall be Authorized Building Controls Specialist contractor that is regularly engaged in the engineering, programming, installation and service of total integrated Building Management Systems. Bids from wholesalers, distributors or contractors who do not purchase directly from Johnson Controls are not allowed.
 - b. The BMS Contractor shall have a branch facility within a 25-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis. The BMS Contractor shall have at this facility at least eight (8) factory trained, directly employed and full time technical staff, spare parts inventory, and all necessary test and diagnostic equipment.

- c. As evidence and assurance of the BMS contractor's ability to support the Owner's system with service and parts, the BMS contractor must have been in the BMS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
 - d. The BMS architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Management Systems and shall be the manufacturer's latest standard of design at the time of bid.
2. Workplace Safety and Hazardous Materials
- a. Provide a safety program in compliance with the Contract Documents.
 - b. The BMS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.
 - c. The BMS Contractor and its employees and subtrades shall comply with federal, state, and local safety regulations.
 - d. The BMS Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the OSHA rules that have jurisdiction for at least each topic listed in the Safety Certification Manual.
 - e. Hazards created by the BMS Contractor, or its subcontractors shall be eliminated before any further work proceeds.
 - f. Hazards observed but not created by the BMS Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The BMS Contractor shall be required to avoid the hazard area until the hazard has been eliminated.
 - g. The BMS Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.
 - h. The BMS Contractor's safety program shall include written policy and arrangements for the handling, storage, and management of all hazardous materials to be used in the work in compliance with the requirements of the AHJ at the Project site.
 - i. The BMS Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.
3. Quality Management Program
- a. Designate a competent and experienced employee to provide BMS Project Management. The designated Project Manager shall be empowered to make technical, scheduling, and related decisions on behalf of the BMS Contractor. At minimum, the Project Manager shall:
 - 1) Manage the scheduling of the work to ensure that adequate materials, labor, and other resources are available as needed.
 - 2) Manage the financial aspects of the BMS Contract.
 - 3) Coordinate as necessary with other trades.

- 4) Be responsible for the work and actions of the BMS workforce on site.

1.4 BASIS OF DESIGN

- A. The system shall be Johnson Metasys Building Systems, without substitution, to match County of Fresno Standard.

1.5 SUBMITTALS AND OPERATION AND MAINTENANCE MANUALS

- A. Submittals shall be in accordance with Section 20 01 00 and shall include the following:
 1. Contractor qualifications. Manufacturer licenses, contracts or certifications for the installer shall be submitted on manufacturer's letterhead.
 2. Manufacturer's data for all devices.
 3. Manufacturer's data for all software.
 4. Diagrams showing control schematics. Diagrams shall include all sensors, terminal strips, panels, and control devices. Locations of all devices shall be indicated.
 5. Sequence of operation.
 6. Site plan showing conduit trench and pullbox locations. This plan shall also show the conduit termination points inside the buildings.
- B. Operation and Maintenance Manuals: Furnish Operation and Maintenance Manuals for all components. These manuals shall contain full documentation which shall include, without being limited to, the following:
 1. General description and specifications.
 2. Installation and initial checkout procedures.
 3. Complete trouble-shooting procedures and diagrams.
 4. Complete alignment and calibration procedures for all components.
 5. Preventative maintenance requirements.
 6. Detailed schematics and assembly drawings.

1.6 SYSTEM ARCHITECTURE

- A. The direct digital control system shall employ a multi-level distributed processing architecture. A web based front end controller shall act as the host and shall communicate with both the system operator and the stand-alone controllers. The stand-alone controllers shall be microprocessor based and perform the specified data acquisition and control functions. They shall connect to and supervise multiple application specific controllers (ASC). The stand-alone controllers shall perform stand-alone control functions whether in communications with the web based front end controller or not. All independent control loops shall be processed and controlled by the stand-alone controllers. Each stand-alone controller shall store historical data for all connected points for a minimum of 24 hours. Historical data shall include total run-time for each digital point. For analog data, periodic samples shall be stored at the frequency of once per minute. The physical connection and interface with the actual field points shall be accomplished through the ASC's. The ASC's shall be located throughout the data environment, communicate with, and be controlled by the stand-alone controllers. The stand-alone controllers shall be accessible by laptop computer with proper software via cable connection. Access to the system shall also be available through connection at selected space sensors.

PART 2 - PRODUCTS

2.1 SENSORS

- A. Space Temperature Sensor: Room sensor with occupant adjustable set point. Occupant adjustable set point shall be limited by software. Wall mounted temperature sensors shall be mounted with bottom of sensor at 48" above finish floor.
- B. Outside Air Temperature Sensor: Provide one outside air sensor per stand-alone building controller. Install on north wall of building.
- C. Duct Sensor: Averaging sensor shall be used at ducts with greater than 9 square feet of cross sectional area. Sensor shall extend across 75% of the duct. Sensor shall be housed in a NEMA 3R enclosure with proper extension at insulated ducts. Provide access door.
- D. Photocell: Wattstopper EM-24 A 2.
- E. Status Sensor: Current sensing status sensor with sensitivity adjustment.
- F. Smoke Detector: Photoelectric type, 115 VAC. The detector shall operate at air velocities from 300 FPM to 4000 FPM. The detector head shall not require additional filters or screens. Mounted in a sheet metal housing with a removable cover. A visual indication of alarm and power shall be provided on detector front. Manual test and reset switch on front of detector. Power supervisory relay. Minimum of two sets of alarm contacts. UL listed. California State Fire Marshal listed. Air Products and Controls, SM-501Series.

2.2 SYSTEM COMPONENTS

- A. Electric Actuators:
 - 1. General: Fully modulating, UL listed. Visual position indicator, manual override, spring return. Factory weatherproof enclosure where exposed to weather. Belimo.
 - 2. Valve Actuators: Provide with factory mounting brackets and linkage to the control valve. Capable of shutting off against a 50 psi differential.
 - 3. Damper Actuators: Actuators shall be direct mounted onto the damper control shaft without linkage. Damper actuators shall be sized to provide a minimum of 5 inch-pounds of torque per square foot of damper face area.
- B. Lighting Contactors: Contactor with metal enclosure. Square D. Provide low voltage relays to complete the lighting control. For low voltage (120 volt) outside lighting, provide status relay for lighting status. For 277 volt outside lighting, provide current sensor for lighting status.
- C. Web Based Front End Controller with Graphical Interface: Provide color graphics accessible through the Owner's system (with security protocol) which will allow the user to override on/off and temperature set points directly. Real time data shall be continuously updated. The minimum graphic screens shall include the following:
 - 1. Site lay-out locations of all equipment being controlled, control component locations and spaces served. Provide multiple screens – minimum of one screen per building, plus site and others as needed for clarity. By selecting the desired equipment item, a flow diagram shall be displayed for the related equipment (as described below). By selecting a conditioned space, a graphic display of the zone conditions shall be displayed (as described below).

2. Flow diagrams shall be provided for each HVAC system, such as air-handling system, chilled water system, hot water system, condenser water system, package unit system with all inputs and outputs dynamically displayed.
3. Each temperature control zone shall have a screen providing set points, temperatures, and related HVAC system status data.
4. Scheduling screens allowing on/off times shall be set for all the following:
 - a. Pre-determined individual days
 - b. Pre-determined blocks of days (from/to)
 - c. Schedules for "Routine" days
 - d. Schedules for "Special" days
- D. Enclosures: Hinged, lockable front panel. The panel shall be identified with a label as specified. No conduit or other penetration of any kind shall be made on top of the enclosure. If any such entry is made, a plug is not acceptable; replace the enclosure. Hoffman with metal back panel. NEMA 1 for indoor; NEMA 3R for outdoor, NEMA 12 for hazardous locations.
- E. Wiring: Sensor and communication cable shall be shielded cable, wire gage and number of wires as recommended by the system manufacturer. Install per manufacturer's recommendations. No splices will be allowed. Identify both ends at terminal blocks. All wiring that is routed below grade shall have a PVC jacket, CL2-0552. All other wiring shall be plenum-rated, CL3P-0552.
- F. Conduit: Size conduit per the California Electrical Code and then increase by one size, except that the minimum conduit size for low voltage shall be 1" and the minimum conduit size for 120 volt power shall be ¾". For underground conduit, provide 100% spare capacity by installing a second conduit (empty) along all conduit routes.
- G. Labels: All labels, signs, etc. shall be engraved, laminated plastic, white on black background, 1/8" high lettering, minimum.
- H. Trane-Mitsubishi Controller. Trane-Mitsubishi controller with on-site LCD and internet IP accessibility with Factory BACnet Interface Card.
- I. Trane-Mitsubishi Room Sensor/Controller: Shall be wall mounted "in-room" wired remote controller.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: A dedicated ASC shall be provided for every item of new equipment and for every item of existing equipment. All electrical work shall be in accordance with the California Electrical Code and the Electrical Specification Sections. Wiring shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed wiring shall run in conduit parallel to room surfaces; location shall be approved by the Engineer. Wiring in walls or in mechanical rooms, janitor rooms, or storage rooms shall be in conduit. Conduit above roofs shall be rigid conduit. Low voltage wiring in accessible attics may be run without conduit. This wiring shall be strapped to structure at 48" on center and shall not lay on the ceiling. No structural member shall be weakened by cutting, notching, boring or otherwise. Provide power wiring for each device requiring external power. Dedicated circuits shall be provided for devices as required by the manufacturer. Devices or wiring exposed to the weather shall be protected in NEMA 3R enclosures and

weatherproof conduit. All conduit shall include a pull wire. Set, test, and adjust the system for proper operation. Provide connection to the Owner's network for web-based access to stand-alone controllers.

- B. Programming: The Contractor shall be responsible for programming the system and shall coordinate the scheduling (on/off times) with the Owner. All point lists and programming blocks shall be provided by the Contractor. For upgrades or additions to existing systems, all existing programming and existing sequences of operation shall be incorporated into the new system and equipment. The project will not be considered complete until all programming and graphics have been completed and all systems are operational from the location of the web based front end controller.
- C. Control Panels/Enclosures:
 - 1. ASC's, transformers, relays, etc. shall be housed in enclosures. Enclosures shall be installed as shown on plans. Wherever practical, do not locate enclosures above ceilings. Maintain access to enclosures that are located above ceilings (e.g. at VAV boxes).
 - 2. For all enclosures, provide a disconnect switch and an in-line fuse. All wiring shall be terminated at terminal strips – no wire nuts. Provide a plastic covered wiring diagram in each enclosure. All wiring (field and inside enclosures) shall be labeled at both ends with machine printed markers – black on white tape. At packaged equipment, locate the enclosure on the side of the unit without obstructing access or service clearance.
 - 3. Separate 120 volt circuits from low voltage circuits horizontally. A physical barrier is not required. Enclose wiring within the enclosure in 2"x2" Panduit.

3.2 TRAINING

- A. Prior to final acceptance, the Contractor shall provide operational training to the Owner's personnel. The training sessions shall include a complete demonstration of the system. Dates and times of the training sessions shall be coordinated through the Owner not less than one week prior to session. A total of 40 hours of instruction shall be provided - 20 hours initially, and 20 hours to be spread throughout the first year of operation. The Contractor shall maintain a log of training sessions including dates, times and names/titles of those attending. The Contractor shall submit a copy of this log on request.

3.3 TESTING AND ACCEPTANCE

- A. The Contractor shall verify, in the presence of the Owner, the system accuracy and proper function of each controlled device and sensor. The following items shall be successfully demonstrated prior to acceptance by the Owner:
 - 1. All system outputs including controllers, relays, and other control devices shall be addressed and start/stop functions demonstrated.
 - 2. All inputs shall be displayed, and all event-initiated functions shall be demonstrated.
 - 3. Demonstrate program integrity and power restore sequence during and after a power failure and restoration.
 - 4. Deliver all record drawings, wiring diagrams, equipment specifications, operation and maintenance manuals and other documentation as required to describe the system.
 - 5. Complete operator training in the use, programming, and operation of the system.

3.4 SERVICE WORK

- A. Service work shall be performed by service personnel in the direct employ of the controls contractor. The service technicians shall be factory trained and certified by the manufacturer to be competent in all aspects of the installed system. The technician shall have a working knowledge of calibration techniques, preventive maintenance, troubleshooting, software diagnostics and microprocessor repair. Precaution shall be taken to minimize disruption of facility operations by service work.

3.5 SEQUENCE OF OPERATION

- A. System Operation Schedule: The systems shall operate at the following schedule (adjustable by Owner) except as noted:
 - 1. Systems shall operate per specified sequences on Monday through Friday from 7 AM to 6 PM. Systems shall be off on Monday through Friday from 6 PM to 7 AM. Systems shall be off on Saturday and Sunday.
- B. Alarm Condition Display: On any alarm, the Central Workstation shall display the equipment mark number and the specific alarm condition. Upon highlighting the alarming equipment, the program shall have a graphic display function that displays the plan of the building floor with the location of the alarming equipment indicated.
- C. System Report: The DDC/EMS shall prepare a system report on demand. The report shall include the following items in the report:
 - 1. Date and time of the current report.
 - 2. Date and time of the previously reviewed report.
 - 3. List of any alarms that have occurred the since the last report. The list shall include the time of the alarm, unit that had the alarm, and the type of alarm.
 - 4. List of any still active run time notices. The list shall include the time of the initial notice, unit that had the notice, and the type of notice.
 - 5. List of any still active filter change notices. The list shall include the time of the initial notice, unit that had the notice, and the type of notice.
 - 6. List of any off-hours operations that have occurred since the last report. The list shall include the date and time of the off-hours operation, the unit identification number, the physical / service location of the unit, and the duration of the off-hours operation.
- D. Split System Heat Pump (ODU / IDU):
 - 1. DDC/EMS Interface: Provide a DDC/EMS panel and connect to the existing WAN DDC/EMS. Connect to the DDC/EMS interface on the Trane-Mitsubishi Central Controller. Provide programming to allow the DDC/EMS to monitor the room temperatures from the Indoor Units, reset the room temperature setpoints, display alarm conditions from the system.
 - 2. Central Controller: Locate the Central Controller per plans. Wire the central controller to each Outdoor Unit (ODU) system controller as the system is installed. Program the controller to operate the system on the schedule noted above. Alarm conditions of any component on the connected systems shall be able to be reviewed through the Central Controller.
 - 3. ODU: Wire each IDU controller to its respective ODU controller.

4. Indoor Unit (IDU): (Heating setpoint 72°F, Cooling setpoint 75°F) The IDU operation shall be controlled by a factory furnished controller to be mounted on the wall. The wall-mounted controller shall operate the IDU to maintain the heating or cooling setpoint. Wire each IDU controller to its respective ODU controller.
 5. Areas that are required to operate continuously by the Owner shall have the IDU controller set to operate the IDU continuously maintaining setpoint.
 6. Install wall or ceiling occupancy sensors (see plan for location) in the rooms and spaces served by the IDU. If all of the occupancy sensors in the rooms and spaces served by the IDU show no occupants for 15 minutes (adj.), the IDU will turn off until any of the sensors show an occupant.
- E. Exhaust Fan: See Equipment Schedule on Drawings for control.
- F. Domestic Hot Water Circulating Pump: Shall start/stop by DDC/EMS. Status sensor shall report pump status to DDC/EMS.

END OF SECTION

SECTION 260000 GENERAL ELECTRICAL REQUIREMENTS

PART 1 – GENERAL

1.1 SECTION INCLUDES

This section includes general requirements specifically applicable to Divisions 26, 27, & 28; including requirements form Division 1.

1.2 RELATED SECTIONS

- A All included sections under Division 1
- B All included sections under Division 26
- C All included sections under Division 27
- D All included sections under Division 28
- E Plans
- F Manufacturers' manuals, product bulletins, etc.

1.3 REFERENCE STANDARDS AND CODES

- A Standards
 - 1 AEIC – Association of Edison Illuminating Companies
 - 2 ANSI – American National Standards Institute
 - 3 ASTM – American Society of Testing and Materials
 - 4 CBM – Certified Ballast Manufacturers Association
 - 5 EIA – Electronic Industry Association
 - 6 ICEA – Insulated Cable Engineers Association
 - 7 IEEE – Institute of Electrical and Electronics Engineers
 - 8 NEMA – The Association of Electrical and Medical Imaging Equipment Manufacturers
 - 9 FM - Factory Mutual
 - 10 UL – Underwriter's Laboratory's, Inc., Standards for Safety
- B Local codes and authorities having jurisdiction
 - 1 City codes
 - 2 County codes
 - 3 Local fire department
- C State codes and authorities having jurisdiction
 - 1 CBC – California Building Code
 - 2 CEC – California Electrical Code
 - 3 State of California Codes
- D National codes and authorities having jurisdiction
 - 1 NESC – National Electrical Safety Code
 - 2 OSHA – Occupational Safety and Health Act
- E Utilities
 - 1 Local cable company
 - 2 Local electrical company
 - 3 Local telephone company
- F Code compliance
 - 1 All work and materials shall comply with the latest rules, codes and regulations, including, but not limited to the following:
 - a Occupational Safety and Health Act Standards (OSHA).

- b CCR, Title 24, Part 3: California Electrical Code (CEC)
 - c All other applicable Federal, State and Local laws and regulations.
- 2 Code compliance is mandatory. Nothing in these Drawings and Specifications permits work not conforming to National, State, and Local electrical and building codes. Where work is shown to exceed minimum code requirements, comply with Drawings and Specifications.
- 3 No work shall be concealed until after inspection and approval by proper authorities. If work is concealed without inspection and approval, the Contractor shall be responsible for opening the concealed areas, making any required corrections and/or modifications to his work, and restoring the area to its previous condition.

1.4 DEFINITIONS (APPLICABLE TO DRAWINGS AND SPECIFICATIONS)

- A Provide: To supply, install and connect complete and ready for safe and regular operation of particular work referred to unless specifically otherwise noted.
- B Install: To erect, mount and connect complete with related accessories.
- C Supply: To purchase, procure, acquire and deliver complete with related accessories.
- D Work: Labor, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation.
- E Wiring: Raceway, fittings, wire, boxes, related items and connection.
- F Concealed: Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces or in enclosures.
- G Exposed: Either visible or subject to mechanical or weather damage, indoors or outdoors, including areas such as mechanical and storage rooms. In general, any item that is directly accessible without removing panels, walls, ceiling or other parts of structure.
- H Indicated, Shown, or Noted: As indicated, shown or noted on Drawings or Specifications.
- I Above Grade: Not buried in ground and not embedded in concrete slab on ground.
- J Below Grade: Buried in ground or embedded in concrete slab on ground.
- K Underground: Buried in ground, including under building slabs.
- L Connect: Complete hookup of item with required services, including conduit, wire and other accessories.
- M Furnish: Supply and deliver complete.
- N Similar or Equal: Of base bid manufacturer, equal in materials, weight, size, design, and efficiency of specified product, equivalent to Base Bid Manufacturer's product.
- O Reviewed, Satisfactory, Accepted, or Directed: As reviewed, satisfactory, accepted or directed by or to engineer.
- P Motor Controllers: Manual or magnetic starters (with or without switches), individual pushbuttons, or hand-off-automatic (HOA) switches controlling the operation of motors.
- Q Control Devices: Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.
- R Contractor: Electrical Sub Contractor unless stated otherwise.
- S Use (verb): Furnish and install as defined above.

1.5 LICENSES, FEES AND PERMITS

Pay for all City, County or State electrical licenses, fees and permits. Arrange for all required inspections by agencies or authorities having local jurisdiction. The owner shall pay for all inspection fees and permits.

1.6 CONDITIONS AT SITE

- A A visit to the site is required of all bidders prior to submission of bid. All will be held to have familiarized themselves with all discernible conditions and no extra payment will be allowed for work required because of these conditions, whether specifically mentioned or not.
- B Underground or overhead lines or other services that are damaged as a result of this work shall promptly be repaired at no expense to the Owner and to complete satisfaction of the Owner.

1.7 DRAWINGS AND SPECIFICATIONS

- A All Drawings and all Divisions of these Specifications shall be considered as a whole and work of this Division shown anywhere therein shall be furnished under this Division.
- B The Contract Drawings are diagrammatic and indicate the general arrangement of equipment and wiring. Most direct routing of conduit and wiring is not assured. Exact requirements shall be governed by architectural, structural and mechanical conditions of the job. Consult all other Drawings in preparation of the bid. Extra lengths of wiring or addition of pull or junction boxes, etc., necessitated by such conditions shall be included in the bid. Check all information and report any apparent discrepancies before submitting bid.
- C Right is reserved to make change up to ten (10) feet in location of any outlet, device, or equipment prior to roughing in without increasing contract cost.
- D Equipment and fixtures shall be connected to provide circuit continuity in accordance with applicable codes, whether or not each piece of conductor, conduit or protective device is shown between items of equipment or fixtures and the point of circuit origin.

1.8 SAFETY AND INDEMNITY

- A Safety: The Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and not be limited to normal working hours.
- B No act, service, Drawing review or construction review by Owner, the Architect, the Engineers or their Consultants, is intended to include review of the adequacy of the Contractor's safety measures, in on or near the construction site.

1.9 RECORD DRAWINGS

- A Submit record Drawings under provisions of Section 013000.
- B Submit prior to final acceptance inspection, one complete marked-up set of reproducible engineering design Drawings.
 - 1 Fully illustrate revisions made by crafts in course of work.

- 2 Include field changes, adjustments, variances, substitutions and deletions, including Change Orders.
 - 3 Indicate exact location of raceways, equipment, and devices.
 - 4 Indicate exact size and location of underground and under floor raceways, grounding conductors, and duct banks.
 - 5 The record Drawings shall show all the work actually constructed and originally shown on the Drawing based upon the field construction by the Contractor.
- C These Drawings shall be for record purposes for Owner's use and are not considered Shop Drawings.

1.10 MANUFACTURER'S INSTRUCTIONS

- A Where the Specifications call for an installation to be made in accordance with manufacturer's recommendations, a copy of such recommendations shall at all times be kept in the job superintendent's office and shall be available to the Owner's representative.
- B Follow manufacturer's instructions where they cover points not specifically indicated on Drawings and Specifications. If they are in conflict with the Drawings and Specifications, obtain clarification from the Architect or Engineer before starting work.
- C One (1) set of equipment manufacturer's Drawings shall be submitted to the Engineer for their record.

1.11 OPERATING AND MAINTENANCE MANUALS

- A Operating and maintenance manuals and close-out documents are used interchangeably
- B Submit operating and maintenance manuals of equipment in the following format. Owner shall decide which format they prefer.
- 1 Three (3) hardcopy sets
 - 2 PDF format
- C For specific requirements, see the sections in which the equipment is specified.

1.12 QUALITY ASSURANCE

- A Provide a meaningful quality assurance program. To assist the Contractor in this program, the Specifications contained herein are set forth as the minimum acceptable requirements. This does not relieve the Contractor from executing other quality assurance measures to obtain a complete operating facility within the scope of this project.
- B The Contractor shall insure that workmanship, materials employed, required equipment and the manner and method of installation conforms to accepted construction and engineering practices, and that each piece of equipment is in satisfactory working condition to satisfactorily perform its functional operation.

1.13 GUARANTEE

Guarantee the installation free from defects of workmanship and materials for a period of one (1) year after Date of Certificate of final payment and promptly remedy any defects developing during this period, without charge.

1.14 BIDDING

- A The contractor shall bid on the plans, specifications, etc. that constitute the contract documents.
- B The contractor shall not attempt to modify the contract documents without the approval of the electrical engineer.
- C All “value engineering” proposals shall be submitted in to the electrical engineer writing.
- D If the contractor makes changes to the contract documents not approved by the electrical engineer, the contractor will still be responsible for installing all devices, conductors, conduits, etc. the contract documents call for.

1.15 ABBREVIATIONS

| | |
|--------|---|
| AIC | Amps interrupting capability |
| ANSI | American National Standards Institute |
| ASTM | ASTM International, formerly American Society for Testing and Materials |
| ATC | Astronomical time clock |
| ATS | Automatic transfer switch |
| CAD | Computer aided design |
| CATV | Cable television |
| CBC | California Building Code |
| CCTV | Closed circuit television |
| CEC | California Electrical Code |
| CFC | California Fire Code |
| CFR | Code of Federal Regulations |
| CMC | California Mechanical Code |
| CPC | California Plumbing Code |
| CSFM | California State Fire Marshal |
| DPDT | Double pole, double throw |
| DPST | Double pole, single throw |
| DVR | Digital video recorder |
| EIA | Electronic Industries Association |
| EMT | Electrometallic conduit |
| EOR | Engineer of record |
| EPA | Effective projected area |
| FACP | Fire alarm control panel |
| FMC | Flexible metallic conduit |
| GRS | Galvanized, rigid steel conduit |
| HVR | Hybrid video recorder |
| ICC-ES | International Code Council Evaluation Service |
| IDF | Intermediate data frame |
| IEEE | Institute of Electrical and Electronic Engineers |
| IES | Illuminating Engineering Society of North America |
| IMC | Intermediate metallic conduit |
| I/O | Input/output |
| IOR | Inspector of record |
| IP | Internet protocol |
| ISO | International Organization for Standardization |
| LAN | Local area network |
| LCD | Liquid crystal display |

| | |
|------|---|
| LCP | Lighting control panel/lighting relay panel |
| LED | Light emitting diodes |
| LPI | Lightning Protection Institute |
| MDF | Main data frame |
| NEC | National Electrical Code |
| NEMA | Association of Electrical Equipment and Medical Imaging Manufacturers |
| NETA | National Electrical Testing Association |
| NFPA | National Fire Protection Association |
| NIST | National Institute of Standards and Technology |
| OCPD | Overcurrent protection device |
| PDF | Portable document format |
| PG&E | Pacific Gas and Electric |
| PTZ | Pan, tilt, zoom |
| SCCR | Short circuit current rating |
| SPD | Surge protective device |
| SPDT | Single pole, double throw |
| SPST | Single pole, single throw |
| THD | Total harmonic distortion |
| TIA | Telecommunications Industries Association |
| UL | Underwriters' Laboratories |
| USB | Universal series bus |
| UPS | Uninterruptable power supply |
| VFD | Variable frequency drive |
| VOIP | Voice over Internet protocol |
| VPN | Virtual private network |
| WAN | Wide area network |

PART 2 – PRODUCTS

2.1 MATERIAL APPROVAL

- A All materials must be new and bear Underwriters' Laboratories label. Materials that are not covered by UL testing standards shall be tested and approved by an independent testing laboratory or a governmental agency.
- B Material not in accordance with these Specifications may be rejected either before or after installation.
- C Materials or equipment specified by:
 - 1 Name of manufacturer.
 - 2 Brand or trade name.
 - 3 Catalog reference.

2.2 SUBSTITUTIONS

- A Base the bid on use of materials specified.
- B Equipment other than specified will be considered for approval provided it meets previous items A through C and the following is submitted in writing by the Contractor to the Engineer to allow approval at least 14 days before the bid date:
 - 1 The request for permission to substitute shall be accompanied with a statement of the amount of money to be returned to the contract if the substitution is permitted.
 - 2 Return a completed request for substitution form.

- C The engineer is the sole judge of acceptability of preferred substitutions.
- D If a substitute is permitted, and any re design effort is thereby necessitated, the required re design shall be at the Contractor's expense.

2.3 SUBMITTALS

Submit to architect, or engineer if no architect is involved, seven (7) copies of complete Shop Drawings and materials lists, as noted below, for review within thirty (35) days after award of contract. All proposed deviations from Specifications must be clearly listed and submitted separately under a prominent heading entitled "Substitutions."

- A Fire Alarm Systems
- B Communication Systems
- C Pull Boxes and Cabinets
- D Conduit and Wire
- E Service and distribution
- F Transformers

2.4 OPERATING AND MAINTENANCE MANUALS

Submit Operating and Maintenance Manuals of equipment as specified under Division 1. Verify exact quantity with architect, or engineer if no architect is involved.

2.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A Equipment shall be shipped in its original packages, to prevent damaging or entrance of foreign matter. Handling and shipping shall be performed in accordance with manufacturer's recommendations. Provide protective covering during construction.
- B Replace at no expense to Owner, equipment or material damaged during the storage or handling, as directed by the engineer.
- C Equipment shall be tagged with a weatherproof tag identifying equipment by name and purchase order number. Packing and shipping lists shall be included.

PART 3 – EXECUTION

3.1 CLEARANCE

Minimum code required clearances for electrical equipment shall not be violated.

3.2 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS

- A Only quality workmanship will be accepted. Haphazard or poor installation practice will be cause for rejection of work.
- B The Electrical Contractor shall provide a Superintendent in charge of this work at all times to direct the quality of the installation.

3.3 COORDINATION

- A Coordinate work with other trades to avoid conflict and to provide correct rough in and connection for equipment furnished under other trades and requiring electrical connections. Inform Contractors of other trades of the required access to and

clearances around electrical equipment to maintain serviceability and code compliance.

- B Verify equipment dimensions and requirements with provisions specified under this Section. Check actual job conditions before fabricating work. Report necessary changes in time to prevent needless work. Changes or additions subject to additional compensation and agreed price shall be at Contractor's risk and expense.
- C Provide temporary feeds and connections to areas and equipment as required to allow phased construction and operation.

3.4 CUTTING AND PATCHING

All cutting and patching required for work of this Division is included herein. Coordination with General Contractor and other trades is imperative. Contractor shall bear the responsibility for and bear the added expense of adjusting for improper holes, supports, etc.

END OF SECTION

SECTION 260500 BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 – GENERAL

1.1 SECTION INCLUDES

Materials, equipment fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction, for the following:

- A Conduit and raceways
- B Wire and cables
- C Outlet boxes
- D Junction boxes
- E Pull boxes
- F Grounding

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A Division 1
 - 1 Section 013000: Administrative Requirements
 - 2 Section 013300: Submittal Procedures
 - 3 Section 014000: Quality Requirements
 - 4 Section 016000: Product Requirements
 - 5 Section 017000: Execution and Closeout Requirements
 - 6 All other included sections under Division 1
- B All included sections under Division 26
- C All included sections under Division 27
- D All included sections under Division 28
- E Plans
- F Manufacturers' manuals, product bulletins, etc.

1.3 REFERENCE STANDARDS AND CODES

Published specification standards, tests or recommended methods of trade, industry or government organizations apply to work in this section as cited in Section 260000.

- A American Society for Testing and Materials
 - 1 ASTM B3: Standard Specification for Soft or Annealed Copper Wire
 - 2 ASTM B33: Standard Specification for Tin-Coated or Annealed Copper Wire for Electrical Purposes
 - 3 ASTM B738: Standard Specification for Fine-Wire Bunch-Stranded and Rope-Lay Bunch-Stranded Copper Conductors for Use as Electrical Conductors
 - 4 ASTM B355: Standard Specification for Nickel-Coated, Soft or Annealed Copper Wire
 - 5 ASTM D412: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
- B California Electrical Code (CEC)
- C Institute of Electrical and Electronic Engineers (IEEE)
 - 1 IEEE 81: Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements

- 2 IEEE 82: Standard Test Procedure for Impulse Voltage Tests on Insulated Conductors
 - 3 IEEE 95: Standard Test Procedure for Impulse Voltage Tests on Insulated Conductors
 - 4 IEEE 141: Recommended Practice for Electric Power Distribution for Industrial Plants
 - 5 IEEE 142: IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems
 - 6 IEEE 241: Recommended Practice for Electric Power Systems in Commercial Buildings
 - 7 IEEE 242: Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (IEEE Buff Book)
 - 8 IEEE 399: Recommended Practice for Industrial and Commercial Power Systems Analysis (Brown Book)
 - 9 IEEE 442: Guide for Soil Thermal Resistivity Measurements
 - 10 IEEE 576: Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications
 - 11 IEEE 1185: Recommended Practice for Cable Installation in Generating Stations and Industrial Facilities
 - 12 IEEE 1584: Guide for Performing Arc Flash Hazard Calculations
 - 13 IEEE 1584a: Guide for Performing Arc-Flash Hazard Calculations-- Amendment 1
 - 14 IEEE 1584b: Guide for Performing Arc-Flash Hazard Calculations-- Amendment 2: Changes to Clause 4
- D Underwriters' Laboratories
- 1 UL 1: Flexible Metal Conduits
 - 2 UL 4: Armored Cable
 - 3 UL 6: Electrical Rigid Metal Conduit – Steel
 - 4 UL 13: Power Limited Circuit Cables
 - 5 UL 83: Thermoplastic Insulated Wires and Cables
 - 6 UL 310: Electrical Quick-connect Terminals
 - 7 UL 360: Liquid Tight Flexible Steel Conduit
 - 8 UL 444: Communications Cables
 - 9 UL 467: Grounding and Bonding Equipment
 - 10 UL 486A: Wire Connectors
 - 11 UL 486B: Wire Connectors
 - 12 UL 486C: Splicing Wire Connectors
 - 13 UL 486D: Sealed Wire Connector Systems
 - 14 UL 486E: Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
 - 15 UL 493: Thermoplastic Insulated Underground Feeder and Branch Circuit Cables
 - 16 UL 510: Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
 - 17 UL 514A: Metallic Outlet Boxes
 - 18 UL 514B: Conduit, Tubing, and Cable Fittings
 - 19 UL 514C: Nonmetallic Outlet Boxes, Flush-device Boxes, and Covers
 - 20 UL 514D: Cover Plates for Flush-mounted Wiring Devices
 - 21 UL 568: Nonmetallic Cable Tray System
 - 22 UL 635: Insulating Bushings
 - 23 UL 651: Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

- 24 UL 797: Electrical Metallic Tubing – Steel
- 25 UL 854: Service Entrance Cables
- 26 UL 870: Wireways, Auxiliary Gutters, and Associated Fittings
- 27 UL 969: Marking and Labeling Systems
- 28 UL 1242: Standard for Electrical Intermediate Metal Conduit - Steel
- 29 UL 1332: Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment
- 30 UL 1446: Systems of Insulating Materials – General
- 31 UL 1479: Fire Tests of Through Penetration Firestops
- 32 UL 1565: Position Devices (includes cable ties and clamps)
- 33 UL 1581: Reference Standard for Electrical Wires, Cables, and Flexible Cords
- 34 UL 1652: Flexible Metallic Tubing
- 35 UL 1685: Vertical-tray Fire Propagation and Smoke Release Test for Electrical and Optical Fiber Cables
- 36 UL 1773: Standard for Termination Boxes
- 37 UL 1977: Component Connectors for Use in Data, Signal, Control, and Power Applications
- 38 UL 2024: Standard for Signaling, Optical Fiber and Communications Raceways and Cable Routing Assemblies
- 39 UL 2196: Test for Fire Resistive Cables
- 40 UL 2239: Hardware for the Support of Conduit, Tubing, and Cable
- 41 UL 2256: Nonmetallic Sheathed Cable Interconnects
- 42 UL 2257: Identification Tests for Jacket and Insulation Materials Used in Plenum Cables
- 43 UL 2277: Flexible Motor Supply Cable and Wind Turbine Tray Cable
- 44 UL 2459: Insulated Multi-pole Splicing Wire Connectors
- 45 UL 2556: Wire and Cable Test Methods

1.4 QUALITY ASSURANCE

- A Equipment and accessories shall be the product of a manufacturer regularly engaged in its manufacture.
- B Supply equipment and accessories new, free from defects.
- C Equipment and accessories in compliance with the applicable standards listed in Article 1.3 of this section and with applicable national, state and local codes.
- D Items of a given type shall be the products of the same manufacturer.
- E Deliver, store and protect products under provisions of Section 016000.
- F Ship equipment in its original packages, to prevent damaging or entrance of foreign matter. Perform handling and shipping in accordance with manufacturer's recommendations. Provide protective covering during construction.
- G Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by the engineer.
- H Tag items with a weatherproof tag identifying equipment by name and purchase order number. Include packing and shipping lists.

1.5 SUBMITTALS

- A Submit under provisions of Section 013000 or 013300.
- B Submittals shall include the following:

- 1 Table of contents
 - 2 A complete set of detailed manufacturer's specifications describing and illustrating all standard and special components and materials
 - 3 Part numbers
 - 4 Evidence of compliance with the applicable standards listed under Article 1.3 of this section
 - 5 Maintenance instructions and intervals
 - 6 Calibration procedures and intervals
 - 7 A complete set of drawings for any special items
 - 8 Wiring diagrams
- C Electronic submittals shall be searchable
- D Seismic Restraint and Anchorage: Provide complete seismic anchorage and bracing for the lateral and vertical support of conduit and electrical equipment in accordance with CBC, Title 24, Part 2, Section 1616A.1 and ASCE 7-10 Section 13.6, and all provisions of this Section.
- 1 Submit calculations prepared and signed by a Structural Engineer licensed in the State of California, showing compliance with the above for all electrical equipment weighing more than 50 pounds, excepting items corresponding exactly in configuration and weight to those specified and detailed. Where anchorage details are not shown on drawings, the field installation shall be subject to the approval of the Electrical Engineer.
 - 2 All equipment mounted on concrete shall be secured with post-installed concrete requiring a drilled hole. Power driven anchors are not acceptable. Minimum spacing shall be 10 diameter center to center and 5 diameters center to edge of concrete. Maximum allowable loads for tension and shear shall be as determined in compliance with ACI 318-14 Chapter 17 and the anchor's ICC or IAPMO evaluation report. Acceptable manufacturers are Hilti, Red Head, and Simpson Strong Tie.
 - 3 Conduit and suspended equipment shall be provided with supports and seismic restraints in accordance with Unistrut, Inc. Seismic Bracing Guide, or Super Strut Inc., Seismic Restraint System guide. Support requirements shall be based upon similar equipment; i.e., water piping as equivalent to conduit with wire fill. A copy of the guide shall be on the job site during construction.
- E The submittal shall be substantially complete for all items and equipment furnished under this section.
- F Individual drawings and data sheets submitted at random intervals will not be accepted for review.
- G Substitutions: Items of same function and performance shall be submitted in conformance with Division 1.

1.6 OPERATION AND MAINTENANCE MANUALS

- A Submit operation and maintenance manuals in accordance with Section 260000.
- B The manuals shall, at minimum, include the following:
- 1 Table of contents
 - 2 Manufacturer (including contact information)
 - 3 Model number
 - 4 Voltage ratings
 - 5 Current ratings
 - 6 List of capabilities

- 7 Environmental ratings
- 8 NEMA enclosure type
- 9 Maintenance instructions and intervals
- 10 Calibration procedures and intervals
- 11 Installation instructions
- 12 Repair instructions (where applicable)
- 13 As-built drawings
- C Provide manuals in one of the following formats
 - 1 Three hardcopies
 - 2 PDF

PART 2 – PRODUCTS

2.1 CONDUIT AND OTHER RACEWAYS

- A Rigid Conduit, also referred to as Galvanized Rigid Steel Conduit (GRS)
 - 1 Material: High strength steel
 - 2 Coating
 - a All uses: hot-dipped galvanized
 - b Underground or corrosive areas
 - 1 40-mil, UV stabilized PVC coated
 - 2 Coating shall conform to NEMA RN-1
 - 3 Fittings shall be threaded.
 - 4 Conduit shall be UL-6 listed.
- B Intermediate Metal Conduit (IMC)
 - 1 Material: Steel
 - 2 Coating
 - a All uses: hot-dipped galvanized
 - b Underground or corrosive areas
 - 1 40-mil, UV stabilized PVC coated
 - 2 Coating shall conform to NEMA RN-1
 - 3 Conduit shall be UL-1242 listed.
- C Electrical Metallic Tubing (EMT)
 - 1 Material: Steel
 - 2 Coating
 - a All uses: hot-dipped galvanized
 - b Underground or corrosive areas
 - 1 40-mil, UV stabilized PVC coated
 - 2 Coating shall conform to NEMA RN-1
 - 3 Fittings shall be threaded.
 - 4 Connectors and couplings
 - a Water tight, steel compression type exterior and in wet locations. Use ETP Fittings InspectoRidge or approved equal when possible.
 - b Steel set screw type in interior, dry locations.
- D Non-metallic conduit
 - 1 Conduit shall be schedule 40 PVC (minimum)
 - 2 Approved for use as non-metallic raceway with 90°C conductors
 - 3 Comply with NEMA TC-2 and NEMA TC-3
- E Flexible Metallic Conduit
 - 1 Material: High strength, hot-dipped galvanized steel

- 2 Construction: Interlocked
- 3 Conduits in damp, wet, or corrosive areas shall be liquid tight type with PVC jacket extruded over the steel conduit.
- F Fittings and accessories
 - 1 Fittings and accessories for all conduit types shall be approved for the purpose and equal in all respects to the conduit or raceway.
 - 2 Fittings and accessories for metallic conduits shall be made of ferrous metal and galvanized after fabrication.
- G Pull lines
 - 1 Pull line shall be 1/8 inch diameter, yellow color.
 - 2 Pull lines shall be Tubbs Cordage "Polyline" or approved equal.
- H Wireways
 - 1 NEMA type
 - a NEMA-1 for dry locations
 - b NEMA-3R or NEMA-4 for damp and wet locations
 - c NEMA-4X for corrosive locations
 - 2 Metal type
 - a Non-corrosive locations: mild steel
 - b Corrosive locations: stainless steel
 - 3 Thicknesses
 - a 6"x6" cross-section and smaller: 16 gauge
 - b 8"x8" cross-section and larger: 14 gauge
 - 4 Finish: The entire enclosure shall be finished as follows:
 - a Degreasing
 - b Cleaning
 - c Phosphatizing
 - d Electrostatic deposition of polymer polyester powder coating followed by baking to produce a hard durable finish.
 - 1 The average thickness of the paint film shall be 2.0 mils.
 - 2 Paint film shall be uniform in color and free from blisters, sags, flaking and peeling
 - e Finish shall conform to UL 50 and UL 50E.
 - f Color shall match surrounding area.
 - 5 Covers
 - a Wireways shall have hinged covers.
 - b NEMA 3R, 4 and 4X wireways shall be a gasket on the inside of the cover to seal the wireway when cover is closed.
 - c Covers shall have latches to secure the cover in the closed position.
 - 6 Wireways shall be UL listed.
- I Raceways shall be UL listed.

2.2 WIRE AND CABLE

- A Conductors for power and lighting systems 600V or less:
 - 1 Conductors shall be 90°C rated.
 - 2 Conductors size #12 AWG and larger shall be stranded copper.
 - 3 Type:
 - a THWN for wet or underground locations
 - b THHN for dry locations.
 - c 90°C rated
 - 4 Minimum conductor size for voltage drop:

- a Minimum size #12 AWG for runs 50 feet or less for 208/120V systems or 100 feet or less for 480/277V systems
 - b Increase conductor by one size by one method below:
 - 1 For each additional 50 feet for 208/120V systems or 100 feet for 480/277V systems.
 - 2 Calculate voltage drop and size as directed by CEC Voltage Drop Restrictions.
 - c Underground circuits shall be #8 AWG minimum wire, unless otherwise noted.
 - d Once the contractor has determined conductors' route, calculate the minimum size to meet maximum voltage drop allowed per CEC using $D_{min}=C*L/(V_D*N)$.
 - 1 D_{min} is the minimum diameter (circular mills)
 - 2 $C=24$ for copper, $C=39$ for aluminum
 - 3 L is conductor length (feet)
 - 4 I is the current (amps)
 - 5 V_D is the maximum allowable voltage drop (volts)
 - 6 N is the quantity of parallel conductors per phase
 - 5 Minimum size conductors for OCPD shall be determined from CEC Table 310.16 with ampacity corrected for 115°F.
 - 6 Conductor size shall be the largest size to meet maximum voltage drop (2.2 A 4) and to meet CEC ampacity requirements (2.2 A 5).
- B For Signal and Communication Circuits:
- 1 Special Cables: As specified on Drawings.
 - 2 Conductors for general communications use: Stranded copper conductor, #16 AWG minimum, with THWN insulation for underground or wet locations and THHN insulation for dry locations.
 - 3 Ends of stranded conductors shall be tinned.

2.3 OUTLET BOXES, JUNCTION BOXES, AND PULL BOXES

- A Above ground locations
 - 1 Outlet Boxes
 - a Hot-dipped galvanized after fabrication
 - b Of required size, minimum 4 inches square, for flush mounted devices and lighting fixtures
 - c Cast type with gasketed covers for outdoor or wet locations.
 - d Device and fixture back boxes shall be 2-1/4" deep, minimum.
 - 2 Junction and Pull Boxes
 - a Use outlet boxes with appropriate covers as junction boxes wherever possible.
 - b Larger junction and pull boxes
 - 1 Sheet steel, hot dipped galvanized after fabrication, finished gray baked enamel
 - 2 Sized according to code
 - 3 Screw-on covers.
- B In-ground pull boxes, handholes, and manholes
 - 1 Precast concrete type with required extension collars.
 - 2 Covers

- a Lids shall be steel or reinforced concrete, as shown on plans. Pull box lids in traffic areas or large grassy areas subject to mowing by riding mowers shall traffic rated.
 - b Covers shall include hold down bolts.
 - c Top of cover shall be flush with top of box.
 - d Covers shall be identified as ELECTRICAL, SIGNAL, or COMMUNICATIONS unless otherwise specified.
- 3 Size boxes as indicated on Drawings. If size is not indicated on Drawings, use CEC as a minimum requirement.
 - 4 Boxes shall have 2" thick (minimum), reinforced concrete bottoms with 1" diameter drain hole over 12" of crushed rock.
 - 5 Boxes shall have approved cable supports.
 - 6 Concrete encased stubs for handholes extending five (5) feet beyond handhole.
 - 7 All pull boxes shall be no smaller than a Christy N-9.
 - 8 All pull boxes shall be set flush to finished grade and shall have an 8-inch wide by 3-inch thick concrete mow strip poured around it.
 - 9 Manufacturer shall be Brooks Products, Oldcastle Enclosure Solutions (Christy), Jensen Precast, or approved equal.
 - 10 All sections between box, extension rings, etc. and penetrations shall be sealed with mortar.
- C Floor Boxes
- 1 Provide Walker or equal Modulink non-metallic floor box for concrete areas.
 - 2 Provide quantity of boxes required to accommodate each device.
 - 3 Provide Walker Wood Floor Boxes at wood floors provide quantity required to accommodate each device.
 - 4 Provide brass flip cover lids.
- D Outlet boxes, junction boxes, pull boxes, etc. recessed in a concrete wall shall be deep masonry boxes.

2.4 CONDUIT AND EQUIPMENT SUPPORTS

- A Conduit supports
- 1 For Individual conduit runs not directly fastened to the structure: Rod hangers
 - 2 For multiple conduit runs: Trapeze type conduit support designed for maximum loading deflection not exceeding manufacturer's recommendations.
- B Materials
- 1 All materials not otherwise noted:
 - a Steel with the finished part hot dipped galvanized
 - b Stainless steel for corrosive or damp environments
 - 2 All bolts and nuts shall be stainless steel.
- C Supports anchored to earth shall be anchored in a concrete base per details.
- D Manufacturers shall be Caddy, Unistrut, Powerstrut, or approved equal.
- E All exposed channels shall have end caps made by the channel manufacturer and designed for use with the channel.

2.5 WIRE CONNECTORS

- A For wire size #8 AWG and smaller: Insulated, screw type, rated 105°C, 600V for building wiring and 1000V for fixtures; Scotchlok, Ideal, or approved equal.
- B For wire size #6 AWG and larger: T&B or approved equal screw type with 3M "#33+" or Plymouth "Slipknot Gray" tape insulation.
- C Underground wire splices
 - 1 Connect ends of conductors with copper compression connectors, 3M Scotchlok or approved equal.
 - 2 Seal splice with inline resin splice kit approved for weather exposure, direct burial, and wet locations, 3M Scotchcast or approved equal.
- D Only set screw, compression type connectors may be used for MC cables. Fish hook/open tang connectors are prohibited.

2.6 GROUNDING

- A Ground Rods
 - 1 3/4 inch diameter
 - 2 Copper weld type
 - 3 10 feet in length.
- B Ground Wire: Conductors shall be medium-hard drawn, copper, and stranded, with sizes as shown on drawings.
- C Utilize CADWELD Multi-System Exothermic Welding for below grade ground connections.
- D Bolts, nuts, and washers shall be bronze, cadmium plated steel, or other corrosion resistant material approved for the purpose.

2.7 MISCELLANEOUS MATERIALS

- A All screws, bolts, nuts, and washers on equipment outdoors or in wet or corrosive environments shall be stainless steel.

2.8 SEALANTS

- A General purpose sealant: One part polysulfide or polyurethane, Federal Standard TT-S-00230c or two-part polyurethane, Federal Standard TT-SS-227E of Mameco Vulkem 116 or 227 or approved equal product manufactured by Products Research and Chemical Corporation. Pecora, Sika, Sonneborn, or Tremco may be substituted under provisions of Section 016000.
- B Conduit sealant
 - 1 Two part, self curing urethane
 - 2 Non-sagging
 - 3 Liquid and gas tight
 - 4 Chemically stable once cured
 - 5 Compatible with conduit and conductor materials
 - 6 Designed for use as conduit seal
- C Fire retardant sealant: Dow Corning Company, Type 3-6548 silicone RTV foam sealant, closed cell, 18 lb. density, 2-part system with UL certification. Type 96-081 one-part sealant shall be used for small spaces and cracks. 3M Fire Barrier Caulk CP25 is also acceptable.

2.9 IDENTIFICATION

- A Nameplates:
 - 1 White, acrylic plastic suitable for indoor or outdoor use
 - 2 Face colored as below with engraved, white, 3/16" minimum, Arial or similar font characters
 - a Equipment on normal systems: Black face
 - b Equipment on emergency systems: Red face
 - 3 Clear plastic overlay suitable for indoor or outdoor use that can be replaced if vandalized.
 - 4 Sign shall include device name, voltage, and size.
 - 5 Outdoor nameplates shall be UV stable and fade resistant.
- B Pull line identification tags:
 - 1 Aluminum plate
 - 2 1/8" tall (minimum), Arial (or similar) font, identifying text stamped on plate
 - 3 Tags shall describe conduit's length, source, and destination.

PART 3 – EXECUTION

3.1 GENERAL

- A Electric system layouts indicated on the Drawings are generally diagrammatic but shall be followed as closely as actual construction and work of other trades will permit. Govern exact routing of cable and wiring and the locations of outlets by the structure and equipment served. Dimensions shall be taken from Architectural Drawings.
- B Consult all other Drawings. Verify scales and report any dimensional discrepancies or other conflicts to architect, or engineer if no architect is involved, before submitting bid.
- C Home runs to panelboards are indicated as starting from the outlet nearest the panel and continuing in the general direction of that panel. Continue such circuits to the panel as though the routes were completely indicated. Terminate homeruns of signal, alarm, and communications system in a similar manner.
- D Avoid cutting and boring holes through structure or structural members wherever possible. Obtain prior approval of Architect and conform to structural requirements when cutting or boring the structure is necessary or permitted.
- E Furnish and install necessary hardware, hangers, blocking, brackets, bracing, runners, required for equipment specified under this section.
- F Provide necessary backing required to insure rigid mounting of outlet boxes.
- G Install pull line in all conduits to remain that will have their conductors removed.

3.2 INSTALLATION OF CONDUIT

- A Run conduit concealed unless otherwise noted or shown on Drawings.
- B Run exposed conduit parallel to or at right angles to center lines of columns and beams.
- C Run no conduit in concrete slabs or floors except at point of penetration. Penetrations shall be at right angles to slab surfaces.
- D Install conduit above ceilings to avoid obstructing removal of ceiling tiles, lighting fixtures, air diffusers, etc.
- E Conduit shall not cross any duct shaft or area designated as future duct shaft. Coordinated with mechanical work to avoid any conflict.

- F Install pull line in empty conduit installed under this contract. Provide and install labels as describe in "Identification" sub-section.
- G Spare conduits shall be capped to prevent intrusion of moisture and foreign objects.
- H Minimum conduit size shall be 1/2 inches when installed above ground and 3/4 inches when installed underground or under building slabs. Increase conduit size as required for wiring. Size for conduit, unless specifically shown otherwise, shall be determined from Table 3 for all conductors, Chapter 9 of latest National Electric Code.
- I Conduit shall be rigid conduit, IMC, EMT, or plastic as follows:
 - 1 Above ground and dry locations: Use rigid conduit, IMC or EMT.
 - a Wet locations: Rigid conduit, IMC.
 - b Locations subject to mechanical injury: Rigid conduit or IMC only.
 - c In concrete walls or block walls: Rigid steel conduit or IMC only.
 - d Dry locations and not subject to mechanical injury: EMT (interior locations only), IMC, or rigid conduit.
 - 2 Underground: Use wrapped rigid steel or plastic.
 - a Schedule 40 PVC: For use underground where protected by concrete slabs, asphaltic pavement, or concrete walkways. Use steel elbows for plastic conduit runs penetrating floor slabs. Bends in plastic conduit other than normal long sweeps shall be made only with factory formed ells or curved segments. Heat bending may not be used. Sections of rigid steel conduit runs are required where direction changes. In all cases where use of plastic conduit is allowed or specified, Contractor may, at his option, use rigid steel conduit.
 - b Underground conduits shall have red 4" wide identifying caution tape reading "CAUTION ELECTRICAL LINE BELOW", length as required and installed 12" above all conduits runs.
 - c Do not install plastic conduit in rock base.
 - d Underground conduit entering building shall be provided with one (1) 10 foot section of rigid steel conduit at point of penetration of foundation, footing or basement wall, with approximately equal lengths inside and outside building line, unless otherwise noted.
 - 3 Bends
 - a Make risers to grade with rigid steel long radius sweep conduit and rigid steel elbow fittings only.
 - b Minimum radius of sweeps shall be 24 inches.
- J Burial depth of conduit shall be as follows:
 - 1 Concrete encased: 24 inch minimum for 600V or lower systems to top of concrete encasement.
 - 2 Conduit without concrete encasement or cap: 24 inch minimum to top of conduit.
 - 3 When installed under buildings, the above minimum depth shall be 18 inches below bottom of floor slab.
- K Use flexible steel conduit in the following applications:
 - 1 Recessed lighting fixtures.
 - 2 Motor connections.
 - 3 Connection between fan plenum and structure.
 - 4 At expansion joints.
 - 5 At transformers and other equipment which produce vibration.

- L Provide junction boxes/pull boxes as required to limit any power system conduit run to a maximum of four (4) 90 degree bends (two (2) 90 degree bends for signal communication system conduit runs) or to avoid "U" bends.
- M Conduit Supports:
 - 1 Support conduit with Underwriters' Laboratories listed conduit support intervals required by the California Electric Code.
 - 2 Wire or sheet metal strips are not acceptable for conduit not directly fastened to structure or for multiple conduit runs.
 - 3 Individual conduit 1/2 inch and 3/4 inch size may be supported from ceiling support wire with Caddy clips only if acceptable to local code. Only one conduit is permitted to be attached to any ceiling support wire. Hang such conduit so as not to affect level of ceiling.
 - 4 Avoid attaching conduit to fan plenums. When it is necessary to support conduit from fan plenum, provide a length of flexible conduit between the section attached to the fan plenum and other sections. Provide a length of flexible conduit between the portion attached to the building to minimize transmission of vibration to the building structure.
- N Conduit penetration of roof, walls, floors and ceilings shall be sealed to preserve the integrity of waterproofing, fire rating and soundproofing for which the roof, wall, floor or ceiling is designed. Materials and methods used shall conform to that specified under Architectural sections.
- O Underground conduit and ducts 2 inches and larger shall be proven clear by pulling through a mandrel 1/4 inch smaller than the inside diameter.
- P Where flush branch circuit panelboards or terminal cabinets are shown on walls, stub a minimum of four (4) 1 inch empty conduit into overhead ceiling spaces and four (4) 1 inch empty conduit into space below floor (if any) in addition to conduit required for circuit wiring.
- Q Paint all exposed conduit to match its surroundings.
- R Plastic conduits exposed to sun light shall be UV stabilized.
- S Where rigid steel conduit runs in direct contact with the earth, conduit shall be wrapped with 10-mil PVC tape to form 40 mil of protection, or shall have factory applied PVC coating.
- T Label all conduits at each terminus, pull box, and junction box.
- U All conduits shall have a minimum of one pull line.
- V All pull lines shall be tagged at both ends so as to indicate the length of the conduit run, source, and the destination.

3.3 INSTALLATION OF WIRE

- A Install all wiring in raceway unless specifically shown or noted otherwise.
- B Pull no wire into any portion of the conduit system until construction work which may damage the wire has been completed.
- C Install wire continuous from outlet to outlet or terminal to terminal. Splices in cables when required shall be made in handholes, pull boxes or junction boxes. Make branch circuit splices in outlet boxes with 8 inches of correctly color-coded tails left in the box.
- D Make splices in wires and cables utilizing specified materials and methods.
- E Cables and wires passing through handholes shall be full looped inside the handhole (360 degree) and supported on galvanized steel racks, beginning 10" above the bottom of the handhole. Leave handhole in clean condition with debris removed.

- F Make ground, neutral, and line connections to receptacle and wiring device terminals as recommended by manufacturer. Provide ground jumper from outlet box to ground terminal of devices when the device is not approved for grounding through the mounting screws.
- G Provide Brady wire markers where number of conductors in a box exceed four (4).
- H Wiring shall be tested for continuity (600V and below). All systems shall be entirely free from grounds, short circuits, and any or all defects.
- I Measure and record the insulation resistance of 600 volt insulated conductors size #4/0 AWG and larger using a 500 volt megger for one minute. Make tests with circuits isolated from source and load.
- J All conductor bends must have a radius greater than or equal to the manufacturer's listed bending radius.
- K Label all conductors at each terminus, pull box, and junction box.

3.4 WIRE COLOR CODE

- A Color code conductors. Wire sized #8 AWG and smaller shall have integral color coded insulation. Wire sizes #6 AWG and larger may have black insulation but shall be identified by color coded electrical tape at junction, splice, pull and termination points. Apply color tape with 1/2 lap to at least 6 inches of the conductor.
- B Color code wire as follows:

| | | | |
|------------|----------|---------------|----------------------------------|
| Conductors | 208/120V | 480/277V | |
| Phase A | Black | Brown | |
| Phase B | Red | Orange | |
| Phase C | Blue | Yellow | |
| Neutral | White | White or Gray | (consistent throughout facility) |
| Ground | Green | Green | |

3.5 CONNECTIONS TO EQUIPMENT

- A General:
 - 1 Furnish and install required power supply conduit and wiring to equipment. See below for other wiring required.
 - 2 Furnish and install a disconnect switch immediately ahead of and adjacent to each magnetic motor starter or appliance unless the motor or appliance is located adjacent to and within sight of the serving panelboard, circuit breaker or switch. Verify equipment nameplate current ratings prior to installation.
 - 3 Mount motor starters including those furnished under other sections or specifications and provide power wiring to them.
 - 4 Install rough-in work for equipment from approved shop drawings to suit the specific requirements of the equipment.
 - 5 Furnish and install magnetic motor starters that are shown on the Drawings or specified under other divisions to be furnished under this division of work. Verify equipment nameplate ratings prior to installation and furnish adequately rated starters for the loads.
 - 6 Furnish and install manual thermal protection for motors not integrally equipped with thermal protection.
 - 7 Furnish and install 120V power to each control panel and time switch requiring a source of power to operate.

- B Heating, ventilating, and air conditioning equipment:
- 1 Coordinate with mechanical contractor for sizes, locations and details of motors, heating units, and control requirements.
 - 2 Provide required power supply conduit and wiring to equipment.
 - 3 Provide a suitable means of disconnect switch immediately ahead of and adjacent to each motor and appliance unless the motor or appliance is located adjacent and within sight of the service panelboard, circuit breaker or switch at a distance allowed by codes. Verify equipment nameplate current ratings prior to installation. Provide a disconnect means at each magnetic motor starter.
 - 4 Provide magnetic motor starters required under this division of work.
 - 5 Provide manual thermal protection for motors not integrally equipped with thermal protection.
 - 6 Line and low voltage temperature control and interlock wiring, conduit, and required connections are a part of other divisions unless specifically shown or noted on the Drawings as to be furnished under this section.
 - 7 Provide 120V power supply to control panels, time switch furnished and installed under other divisions of work.
 - 8 Furnish and install 120V power to each duct detector scheduled for operation of fire dampers or shut down of mechanical equipment. Coordinate the exact quantity and locations with the mechanical drawings.
- C Plumbing and other contractor-furnished and Owner-furnished equipment:
- 1 Required power and control conduit, wiring and connections are included under this section of the work. Control sensing and alarm devices will be furnished under the respective section of the contract supplying the equipment unless noted otherwise. These devices will be located in pipes, ducts, vessels, tanks, etc., and will be mounted in a place by the Contractor furnishing the devices. Other devices shall be mounted under this section of the work.
 - 2 Control panels for packaged equipment will be furnished under the respective section of the contract supplying the equipment unless otherwise noted. Installation and connection of the control panels are under this section of the work.

3.6 SYSTEM NEUTRAL GROUND

- A Ground the neutral conductor of each transformer to limit the maximum potential above ground due to normal operating voltage and limit the voltage level due to abnormal conditions.
- B Ground transformers with secondary voltage 600V class or less as follows: 3 phase, 4 wire wye connected: ground neutral point.
- C For transformers 75kVA size or lower with primary voltage 480V or lower, the primary equipment ground conductor may be used for grounding the secondary neutral provided it is adequately sized in accordance with CEC system ground conductor size.

3.7 EQUIPMENT GROUND

- A Ground non-current carrying metal parts of electrical equipment enclosures, frames, or conductor raceways to provide a low impedance path for line to ground fault current and to bond all non current carrying metal parts together. Install a

ground conductor in each raceway system. Equipment ground conductor shall be electrically and mechanically continuous from the electrical circuit source to the equipment to be grounded. Size ground conductors per CEC 250.95 unless otherwise shown on drawings.

- B Grounding conductors shall be identified with green insulation. Where green insulation is not available, on larger sizes, black insulation shall be used and suitably identified with green tape at each junction box or enclosure device.
- C Install metal raceway couplings, fittings and terminations secure and tight to insure good ground continuity. Provide grounding bushing and bonding jumper where metal raceway is not directly attached to equipment metal enclosure and at concentric knockouts.
- D Lighting fixtures shall be securely connected to equipment ground conductors. Outdoor lighting standards shall have a factory installed ground for terminating the ground wire.
- E Motors shall be connected to equipment ground conductors with a conduit grounding bushing and with a bolted solderless lug connection on the metal frame.

3.8 STRUCTURAL GROUND

- A Concrete encased electrode shall be 2 inches above the bottom of concrete footing where shown on drawings. See drawings for details.
- B Domestic, chilled and hot water mains and fire protection metallic water pipes shall be connected to the ground bus with #4/0 AWG bare copper conductor at a minimum of two points.
- C Miscellaneous metal objects including piping, vessels and structural shapes within six feet of metallic objects connected to the ground system and which are not interconnected mechanically with the grounding system, shall be interconnected with a minimum #6 AWG bare copper conductor.

3.9 IDENTIFICATION

- A Provide and install nameplates on all switchboards, distribution boards, panels, motor starters, VFDs, transformers, safety switches/disconnects, push buttons, selector switches, pilot lights, and other similar devices. Fasten nameplates to equipment with one sheet metal screw at each corner.
- B Provide and install labels on lighting switches and convenience and special purpose receptacles to show panel and circuit number to which the device is connected.
- C Provide and install identification tags on all conduit pull.
- D Provide label meeting ANSI Z535 standards on motors reading:

WARNING
AUTOMATIC EQUIPMENT
MAY START AT ANY TIME

3.10 CIRCUIT BREAKER ELECTRICAL COORDINATION STUDY

- A Contractor shall provide a coordination study to determine trip settings of circuit breakers. Provide an electric copy of the studies to the Electrical Engineer of Record in EasyPower.

3.11 ARC FLASH STUDY

- A Contractor shall provide a study to determine potential arc flash energy. Provide an electric copy of the studies to the Electrical Engineer of Record in EasyPower.

END OF SECTION 26 05 00

SECTION 260526 GROUNDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Materials, equipment fabrication, installation, and tests in conformity with equipment applicable to this project, applicable codes and authorities having jurisdiction, for grounding.

1.2 RELATED SECTIONS

- A. All included sections under Division 1.
- B. All included sections under Division 26.
- C. Plans.
- D. Manufacturers' manuals, product bulletins, etc.

1.3 REFERENCE STANDARDS

- A. Published specifications standards, tests or recommended methods of trade, industry or government organizations apply to work in this section as cited in Section 16000.

1.4 QUALITY ASSURANCE

- A. Equipment and accessories shall be the product of a manufacturer regularly engaged in its manufacture.
- B. Supply equipment and accessories new, free from defects.
- C. Supply equipment and accessories in compliance with the applicable standards listed in Article 1.3 of this section and with applicable national, state, and local codes.
- D. Items of a given type shall be the products of the same manufacturer.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01330. Provide detailed description of items supplied, including specifications, performance characteristics, materials, wiring diagrams and schedules.
 - 1. Submit evidence that products satisfy seismic requirements for the State of California.
 - 2. Submit evidence of compliance with the applicable standards listed under Article 1.3 of this section.
- B. Manufacturer's Instructions: Submit manufacturer's installation instructions.
- C. Product Data: Submit manufacturer's descriptive literature.

- D. Shop Drawings: Submit complete fabrication details, elevations and sections of switchboard, dimensions, space available for conduit, rating, short circuit withstand ability of bus and lowest rated device, circuit schedule showing circuit number, device description, device frame ampere rating and trip, fuse clip ampere rating, termination lug size, feeder and circuit identification, conductor ratings and one-line and wiring diagrams. Include both elementary diagram and terminal to terminal wiring diagrams.
- E. Substitutions: Items of same function and performance shall be in conformance with Division 1.
- F. Submit field test and operations check report for circuit breakers and motor starters under provisions of Section 16080.

1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation instructions, maintenance, and repair data under provisions of Division 1.
- B. Ship equipment in its original packages to prevent damaging or entrance of foreign matter. Perform handling and shipping in accordance with manufacturer's recommendations. Provide protective covering during construction.
- C. Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by the engineer.
- D. Tag items with a weatherproof tag identifying equipment by name and purchase order number. Include packing and shipping lists.

PART 2 - PRODUCTS

2.1 GROUND RODS

- A. Ground rods shall be:
 - 1. 3/4 inch diameter
 - 2. Copper weld type
 - 3. 10 feet in length.
 - 4. Ground rings

2.2 BARE COPPER GROUND WIRE

- A. Conductors shall be medium-hard drawn, copper, and stranded, with sizes as shown on drawings.

2.3 BELOW GRADE GROUND CONNECTIONS

- A. Utilize CADWELD Multi-System Exothermic Welding.

2.4 HARDWARE

- A. Bolts, nuts and washers shall be bronze, cadmium plated steel, or other non-corrosive material, approved for the purpose.

PART 3 - EXECUTION

3.1 SYSTEM NEUTRAL GROUND

- A. Ground the neutral conductor of each transformer to limit the maximum potential above ground due to normal operating voltage and limit the voltage level due to abnormal conditions.
- B. Ground transformers with secondary voltage 600V class or less as follows:
3-phase, 4-wire wye connected: ground neutral point.
- C. For transformers 75kVA size or lower with primary voltage 480V or lower, the primary equipment ground conductor may be used for grounding the secondary neutral provided it is adequately sized in accordance with CEC system ground conductor size.

3.2 EQUIPMENT GROUND

- A. Ground non-current carrying metal parts of electrical equipment enclosures, frames, or conductor raceways, structural metal supports for the mechanical and plumbing equipment to provide a low impedance path for line-to-ground fault current and to bond all non-current carrying metal parts together. Install a ground conductor in each raceway system. Equipment ground conductor shall be electrically and mechanically continuous from the electrical circuit source to the equipment to be grounded. Size ground conductors per CEC 250-95 unless otherwise shown on drawings.
- B. Grounding conductors shall be identified with green insulation. Where green insulation is not available, on larger sizes, black insulation shall be used and suitably identified with green tape at each junction box or enclosure device.
- C. Install metal raceway couplings, fittings and terminations secure and tight to insure good ground continuity. Provide grounding bushing and bonding jumper where metal raceway is not directly attached to equipment metal enclosure and at concentric knockouts.
- D. Lighting fixtures shall be securely connected to equipment ground conductors. Outdoor lighting standards shall have a factory installed ground for terminating the ground wire.
- E. Motors shall be connected to equipment ground conductors with a conduit grounding bushing and with a bolted solderless lug connection on the metal frame.

3.3 STRUCTURAL GROUND

- A. Concrete encased electrode shall be 2 inches above the bottom of concrete footing where shown on drawings. See drawings for details.
- B. Domestic, chilled, and hot water mains and fire protection metallic water pipes shall be connected to the ground bus with #3/0 AWG bare copper conductor at a minimum of two points.

- C. Miscellaneous metal objects including piping, vessels, and structural shapes within six feet of metallic objects connected to the ground system and which are not interconnected mechanically with the grounding system, shall be interconnected with a minimum #3/0 AWG bare copper conductor.

3.4 GROUND RESISTANCE TEST

- A. Building ground electrode resistance testing shall be accomplished with a ground resistance, direct reading, single test meter utilizing the Fall-of-Potential method and two (2) referenced electrodes. Perform test prior to interconnection to other grounding system. Orient the concrete encased ground electrode to be tested and the two referenced electrodes in straight line spaces fifty (50) feet apart. Drive the two (2) reference electrodes ten (10) feet deep.
- B. Test results shall be in writing, and shall show temperature, humidity, and condition of the soil at the time of the tests. In the case where the ground resistance exceeds 25 ohms, add an additional ground rod and retest. Add additional ground rods, when necessary, in order to bring the ground resistance below 25 Ohms. All testing shall be done prior to concrete pour and in the presence of the inspector of record. Provide test results for engineer review.

END OF SECTION

SECTION 260529 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Hangers and supports for electrical equipment and systems.
- B. Construction requirements for concrete bases.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A Division 1
 - 1 Section 013000: Administrative Requirements
 - 2 Section 013300: Submittal Procedures
 - 3 Section 014000: Quality Requirements
 - 4 Section 016000: Product Requirements
 - 5 Section 017000: Execution and Closeout Requirements
 - 6 All other included sections under Division 1
- B All included sections under Division 26
- C All included sections under Division 27
- D All included sections under Division 28
- E Plans
- F Manufacturers' manuals, product bulletins, etc.

1.3 REFERENCE STANDARDS AND CODES

- A Published specifications standards, tests or recommended methods of trade, industry or government organizations apply to work in this section as cited in Section 260000.
- B American Society for Testing and Materials (ASTM)
 - 1 ASTM A36/A36M: Standard Specification for Carbon Structural Steel
 - 2 ASTM A167: Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - 3 ASTM A276: Standard Specification for Stainless Steel Bars and Shapes
 - 4 ASTM A325: Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength
 - 5 ASTM A563: Standard Specification for Carbon and Alloy Steel Nuts
 - 6 ASTM B221: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - 7 ASTM B632: Standard Specification for Aluminum-Alloy Rolled Tread Plate
 - 8 ASTM B633: Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - 9 ASTM E488: Standard Test Methods for Strength of Anchors in Concrete Elements
 - 10 ASTM F594: Standard Specification for Stainless Steel Nuts
- C American Welding Society (AWS)
 - 1 AWS D1.1: Structural Welding Code - Steel
- D California Building Safety Codes (CBSC)
 - 1 California Building Code (CBC)

- 2 California Electrical Code (CEC)
- E General Services Administration
 - 1 FF-S-325
 - 2 W-C-582: Conduit, Raceway, Metal and Fittings: Surface
 - 3 WW-H-171: Hanger and Support, Pipe
- F ICC Evaluation Service (ICC-ES)
 - 1 ESR-1917
- G Manufacturers Standardization Society (MSS)
 - 1 MSS SP-58: Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation
 - 2 MSS SP-69: Pipe Hangers and Supports – Selection and Application
- H Metal Framing Manufacturers' Association
 - 1 MFMA-4: Metal Framing Standard Publication
 - 2 MFMA-101: Guidelines for the Use of Metal Framing
- I National Electrical Contractors Association
 - 1 NECA 1: Standard Practice of Good Workmanship in Electrical Construction
 - 2 NECA 101: Standard for Installing Steel Conduits (Rigid, IMC, EMT)
- J Underwriters' Laboratories
 - 1 UL 2239: Hardware for the Support of Conduit, Tubing, and Cable

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with latest editions of the California Building Code and California Electric Code

1.5 SUBMITTALS

- A. Submit under provisions of Section 013000 or 013300.
- B. Submittals shall include the following:
 - 1. Table of contents
 - 2. A complete set of detailed manufacturer's specifications describing and illustrating all standard and special components and materials
 - 3. Part numbers
 - 4. Evidence of compliance with the applicable standards listed under Article 1.3 of this section
 - 5. Maintenance instructions and intervals
 - 6. A complete set of drawings for any special items
- C. Electronic submittals shall be searchable
- D. Shop drawings shall be stamped and signed by a licensed structural engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers: include product data for components
 - 2. Steel slotted channel systems: include product data for components
 - 3. Equipment supports
- E. Welding certificates
- F. The submittal shall be substantially complete for all items and equipment furnished under this section.
- G. Individual drawings and data sheets submitted at random intervals will not be

accepted for review.

- H. Substitutions: Items of same function and performance shall be submitted in conformance with Division 1.

1.6 OPERATION AND MAINTENANCE MANUALS

- A. Submit manuals at close out.
- B. The manuals shall, at minimum, include the following:
 - 1. Manufacturer (including contact information)
 - 2. Model number
 - 3. Load ratings
 - 4. Material type(s)
 - 5. Environmental ratings
 - 6. Maintenance requirements
 - 7. Installation instructions
 - 8. Repair instructions (where applicable)
- C. Provide manuals in one of the following formats
 - 1. Three hardcopies
 - 2. PDF

1.7 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

PART 2 – PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems
 - 1. Comply with MFMA-4, factory-fabricated components for field assembly.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 3. Nonmetallic Coatings:
 - a. PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - b. Minimum thickness shall be 40 mils.
 - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 5. Channel Dimensions: Selected for applicable load criteria.
 - 6. Manufacturers:
 - a. Cooper B-Line, Inc.

- b. ERICO International Corporation
 - c. Hilti Corporation
 - d. Thomas & Betts Corporation
 - e. Unistrut
 - f. Approved equal
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components:
1. General:
 - a. Anchors shall be steel with corrosion resistant, durable coating or stainless steel
 - b. Select anchors with strength required for anchor and as tested according to ASTM E488.
 - c. Minimum length shall be eight times diameter.
 - d. Tension, shear, and pullout capacities shall be appropriate for supported loads and building materials used
 - e. Post installed anchors must be listed in a current evaluation report issued by one of the following:
 1. International Code Council Evaluation Service (ICC-ES) (<http://www.icc-es.org/reports/index.cfm?search=search>)
 2. City of Los Angeles Research Report
 2. Powder-Actuated Fasteners:
 - a. Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood
 - b. Manufacturers:
 1. Hilti Corporation
 2. Simpson Strong-Tie Co., Inc.
 3. Approved equal
 3. Mechanical-Expansion Anchors:
 - a. Insert-wedge-type, stainless steel, for use in hardened portland cement
 - b. Anchors shall meet the descriptive part of Federal Specifications FF-S-325 Group II, Type 2, Class 2, Style 1.
 - c. Anchors shall be equivalent to Hilti Kwik-Bolt TZ.
 4. Concrete inserts shall be steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58
 5. Clamps for attachment to steel structural elements: MSS SP-58, type suitable for attached structural element
 6. Through bolts shall be structural type, hex head, high strength and comply with ASTM A325
 7. Toggle Bolts: All-steel springhead type
 8. Hanger Rods: Threaded steel

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials:
 - 1. Comply with requirements with ASTM A36 (ferrous metals), ASTM A167 and ASTM A276 (stainless steel), and ASTM B221 and B632 (aluminum) for shapes and plates.
 - 2. Hot dipped galvanized steel
 - 3. Stainless steel for corrosive areas

2.3 CONCRETE BASES

- A. Concrete Pad
 - 1. Concrete shall have strength of 3000 PSI within 28 days.
 - 2. The pad shall be large enough to achieve the following:
 - a. Edge of anchor bolt holes shall be a minimum of 10 times the bolt diameter from edge of pad.
 - b. Edge of equipment shall be a minimum of 8 inches from edge.
 - 3. Minimum thickness shall be 12 inches with 3 inch deep by 12 inch wide footing around perimeter
 - 4. Bottom of footings shall be a minimum of 8" below finished grade.
 - 5. Pad shall include #4 rebar at 10 inch intervals in both x direction and y direction.
- B. Concrete Pole Bases: Refer to Typical Details

PART 3 – EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by California Electrical Code. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables:
 - 1. Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 2. Secure raceways and cables to these supports with two-bolt conduit clamps
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in California Electric Code.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (890 N).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code.
 - 1. Wood framing: Fasten with lag screws or through bolts.
 - 2. Light gauge steel framing: self tapping screws
 - 3. Steel beams: beam clamps
 - 4. Concrete: expansion fasteners

3.3 CONDUIT SUPPORTS

- A. Conduit supports
 - 1. For Individual conduit runs not directly fastened to the structure: Rod hangers
 - 2. For multiple conduit runs: Trapeze type conduit support designed for maximum loading deflection not exceeding manufacturer's recommendations.
 - 3. Wire or sheet metal strips are not acceptable for conduit not directly fastened to structure or for multiple conduit runs.
- B. Support conduit with Underwriters' Laboratories listed conduit support intervals required by the California Electric Code.
- C. Individual conduit 1/2 inch and 3/4 inch size may be supported from ceiling support wire with Caddy clips only if acceptable to local code. Only one conduit is permitted to be attached to any ceiling support wire. Hang such conduit so as not to affect level of ceiling.
- D. Avoid attaching conduit to fan plenums. When it is necessary to support conduit from fan plenum, provide a length of flexible conduit between the section attached to the fan plenum and other sections. Provide a length of flexible conduit between the portion attached to the building and the rest of the conduit run to minimize transmission of vibration to the building structure.
- E. Supports anchored to earth shall be anchored in a concrete base per details.

3.4 INSTALLATION OF POST-INSTALLED ANCHORS

- A. Minimum distances
 - 1. Bolt hole edge to edge of concrete: 10 times bolt diameter
 - 2. Bolt center to bolt center: 12 times bolt diameter
- B. Expansion type anchors
 - 1. Anchor shall be installed and torque per manufacturer's recommendations.
 - 2. Setting verification:
 - a. Torque-controlled anchors: Following attainment of 10% of the required torque, torque-controlled anchors shall not require more than six (6) additional complete turns of the nut during installation to achieve the manufacturer's specified installation torque. The extent

- of bolt projection after installation shall be measured to confirm that this requirement has been met.
- b. Displacement-controlled anchors: The position of the plug in the anchor shell shall be checked with the manufacturer-supplied installation tool or other appropriate device. The position of the plug shall conform to the manufacturer's specifications.
3. Allowable loads
- a. Anchors not installed in underside of beam/slab:
 - 1. When tested in accordance with AC01, Section 5.6: Values listed in ICC-ES report
 - 2. When not tested in accordance with AC01, Section 5.6: 80% of values listed in ICC-ES report
 - b. Anchors installed in underside of beam/slab:
 - 1. When tested in accordance with AC01, Section 5.6: Values for anchor without special inspection or in cracked concrete in ICC-ES report
 - 2. When not tested in accordance with AC01, Section 5.6: 80% of values for anchor without special inspection or in cracked concrete in ICC-ES report
- C. Epoxy-type (adhesive) Anchors
- 1. Allowable loads: values from ICC-ES report when compliant with AC58.
- D. Anchors must receive special inspection per CBC Section 1704.15.

3.5 TESTING AND INSPECTION OF POST-INSTALLED ANCHORS

- A. General
- 1. Post-installed anchors shall be tested in accordance with the provisions of 2001 California Building Code Section 1923A.3.5, by an authority having jurisdiction accepted testing facility, unless approval of an alternative individual is obtained in advance from the authority having jurisdiction.
 - 2. If any anchor fails testing, test all anchors of the same type, not previously tested until twenty (20) consecutive anchors pass, then resume the initial test frequency. If the anchors are used for the support and bracing of non-structural components (pipe, duct or conduit), the twenty (20) shall be only those anchors installed by the same trade.
 - 3. Test equipment (including torque wrenches) is to be calibrated by an approved testing laboratory in accordance with standard recognized procedures.
 - 4. Regardless of which test method is chosen, test values and all appropriate criteria shall be shown on the contract documents.
 - 5. Anchor diameter refers to the thread size for the wedge and sleeve categories, and to the anchor outside diameter for the sleeve category.
 - 6. Apply proof test loads to wedge and sleeve anchors without removing the nut if possible. If not, remove nut and install a threaded coupler to the same tightness as the original nut using a torque wrench to apply the test load.
 - 7. For sleeve/shell internally threaded categories, verify that the anchor is not prevented from withdrawing by a baseplate or other fixtures. If restraint is found, loosen and shim or remove fixture(s) prior to testing.

8. Reaction loads from test fixtures may be applied close to the anchor being tested, provided the anchor is not restrained from withdrawing by the fixture(s).
9. Alternate torque test procedures and test values for shell type anchors may be submitted to the enforcement agency for review and approval on a case-by-case basis when test procedures are submitted and approved by the enforcement agency.
10. Required test loads may be determined by either of the following methods:
 - a. Twice the allowable tension load from Part 3.4.
 - b. Tension or torque test values from the table and procedures.

| Test Values (Hardrock or Lightweight Concrete) | | | | | | | |
|--|------------|------------------|------------|------------------|------------|------------------|------------------|
| Anchor | Wedge | | Sleeve | | Shell | | Screw |
| Diameter (in) | Load (lbs) | Torque (ft. lbs) | Load (lbs) | Torque (ft. lbs) | Load (lbs) | Torque (ft. lbs) | Torque (ft. lbs) |
| 1/4 | 800 | 10 | 400 | 4 | 1000 | - | - |
| 5/16 | - | - | 400 | 5 | 1400 | - | - |
| 3/8 | 1100 | 25 | 700 | 10 | 1800 | - | 10 |
| 1/2 | 2000 | 50 | 900 | 20 | 2700 | - | 10 |
| 5/8 | 2300 | 80 | 1100 | 45 | 3700 | - | 10 |
| 3/4 | 3700 | 150 | 1400 | 90 | 5400 | - | 20 |
| 1 | 5800 | 250 | - | - | - | - | - |

11. If the manufacturer's recommended installation torque is less than the test torque noted in the table, the manufacturer's recommended installation torque should be used in lieu of the tabulated values.

B. Expansion-type Anchors

1. The test load may be applied by any method that will effectively measure the tension in the anchor, such as direct pull with a hydraulic jack, calibrated spring-loaded devices, or a calibrated torque wrench. Displacement-controlled anchors such as drop-ins shall not be tested using a torque wrench.
2. Anchors tested with a hydraulic jack should exhibit no discernable movement during the tension test, e.g., as evidenced by loosening of the washer under the nut.
3. Anchors tested with a calibrated torque wrench must attain the specified torque within 1/2 turn of the nut.
4. Exceptions: Undercut anchors that are so designed to allow visual confirmation of full set, need not be tension or torque tested. If the manufacturer's installation torque is less than the specified test torque, use the manufacturer's specified installation torque for testing the anchor.
5. Apply proof test loads to wedge and sleeve anchors without removing the nut if possible. If not, remove nut and install a threaded coupler to the same tightness as the original nut using a torque wrench to apply the test load.
6. For sleeve/shell internally threaded categories, verify that the anchor is not prevented from withdrawing by a baseplate or other fixtures. If restraint is found, loosen and shim or remove fixture(s) prior to testing.
7. Reaction loads from test fixtures may be applied close to the anchor being tested, provided the anchor is not restrained from withdrawing by the fixture(s).

8. Shell type anchors should be tested as follows:
 - a. Visually inspect 25% for full expansion as evidenced by the location of the expansion plug in the anchor body. Plug location of a fully expanded anchor should be as recommended by the manufacturer, or, in the absence of such recommendation, as determined on the job site following the manufacturer's installation instructions. At least 5% of the anchors shall be proof loaded as indicated in the table above, but not less than three anchors per day for each different person or crew installing anchors, or;
 - b. Test installed anchors per current edition of the CBC Section 1913A.7.
- C. Epoxy-type (adhesive) Anchors
 1. Epoxy-type (adhesive) anchors shall be tension tested per current edition of the CBC Section 1913A.7. The tension test load shall equal twice the allowable load for the specific location of the anchor to be tested (i.e., accounting for edge distance) or 80% of the yield strength of the bolt ($0.8A_bF_y$), whichever is less. The test procedures for expansion-type anchors in the attached table shall also be used for epoxy-type (adhesive) anchors. Torque testing of epoxy-type (adhesive) anchors is not permitted.
 2. Where epoxy-type (adhesive) anchors are used as shear dowels across cold joints in slabs on grade and the slab is not part of the structural system, testing of those dowels is not required.
 3. Anchors shall exhibit no discernible movement during the tension test.
- D. Screw-type Anchors
- E. The following criteria apply for the acceptance of installed anchors:
 1. Hydraulic ram method: The anchor should have no observable movement at the applicable test load. For wedge and sleeve type anchors, a practical way to determine observable movement is that the washer under the nut becomes loose.
 2. Torque wrench method: The applicable test torque must be reached within the following limits:
 - a. Wedge or Sleeve type: One-half (1/2) turn of the nut.
 - b. One-quarter (1/4) turn of the nut for the 3/8 in. sleeve anchor only.

3.6 PAINTING

- A. Touchup:
 1. Clean field welds and abraded areas of shop paint.
 2. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting.
 3. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
 4. Comply with the following requirements
 - a. Architectural painting specifications
 - b. SSPC-PA 1 requirements for touching up field-painted surfaces.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

SECTION 260548 VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SECTION INCLUDES

Anchoring and vibration isolation equipment for electrical equipment:

- A. Isolation pads
- B. Spring isolators
- C. Restrained spring isolators
- D. Channel support systems
- E. Restraint cables
- F. Hanger rod stiffeners
- G. Anchorage bushings and washers

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A Division 1
 - 1 Section 013000: Administrative Requirements
 - 2 Section 013300: Submittal Procedures
 - 3 Section 014000: Quality Requirements
 - 4 Section 016000: Product Requirements
 - 5 Section 017000: Execution and Closeout Requirements
 - 6 All other included sections under Division 1
- B All included sections under Division 26
- C All included sections under Division 27
- D All included sections under Division 28
- E Plans
- F Manufacturers' manuals, product bulletins, etc.

1.3 REFERENCE STANDARDS AND CODES

- A Published specifications standards, tests or recommended methods of trade, industry or government organizations apply to work in this section as cited in Section 260000.
- B American Society for Testing and Materials (ASTM)
 - 1 ASTM A36/A36M: Standard Specification for Carbon Structural Steel
 - 2 ASTM A325: Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength
 - 3 ASTM A563: Standard Specification for Carbon and Alloy Steel Nuts
 - 4 ASTM B633: Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
 - 5 ASTM E488: Standard Test Methods for Strength of Anchors in Concrete Elements
 - 6 ASTM F594: Standard Specification for Stainless Steel Nuts
- C American Welding Society (AWS)
 - 1 AWS D1.1: Structural Welding Code - Steel
- D California Building Safety Codes (CBSC)
 - 1 California Building Code (CBC)
 - 2 California Electrical Code (CEC)
- E General Services Administration

- 1 FF-S-325
- 2 W-C-582: Conduit, Raceway, Metal and Fittings: Surface
- 3 WW-H-171: Hanger and Support, Pipe
- F ICC Evaluation Service (ICC-ES)
 - 1 ESR-1917
- G National Electrical Contractors Association
 - 1 NECA 1: Standard Practice of Good Workmanship in Electrical Construction
- H Underwriters' Laboratories

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency meeting requirements of Part 1.6, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with latest editions of the California Building Code and California Electric Code

1.5 SUBMITTALS

- A. Submit under provisions of Section 013000 or 013300.
- B. Submittals shall include the following:
 - 1. Table of contents
 - 2. A complete set of detailed manufacturer's specifications describing and illustrating all standard and special components and materials
 - 3. Part numbers
 - 4. Evidence of compliance with the applicable standards listed under Article 1.3 of this section
 - 5. Maintenance instructions and intervals
 - 6. A complete set of drawings for any special items
 - 7. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 8. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency meeting requirements of Part 1.6.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 - 9. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.
- C. Electronic submittals shall be searchable

- D. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified licensed structural engineer responsible for their preparation.
 - 1. Design Calculations:
 - a. Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
 - b. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other electrical Sections for equipment mounted outdoors.
 - 2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
 - 3. Field-fabricated supports.
 - 4. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Preapproval and Evaluation Documentation: By an agency meeting requirements of Part 1.6, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- E. Welding certificates.
- F. Field quality-control test reports.
- G. The submittal shall be substantially complete for all items and equipment furnished under this section.
- H. Individual drawings and data sheets submitted at random intervals will not be accepted for review.
- I. Substitutions: Items of same function and performance shall be submitted in conformance with Division 1.

1.6 OPERATION AND MAINTENANCE MANUALS

- A Submit manuals at close out.
- B The manuals shall, at minimum, include the following:
 - 1 Manufacturer (including contact information)
 - 2 Model number
 - 3 Load ratings
 - 4 Material type(s)
 - 5 Environmental ratings
 - 6 Maintenance requirements
 - 7 Installation instructions
 - 8 Repair instructions (where applicable)
- C Provide manuals in one of the following formats
 - 1 Three hardcopies
 - 2 PDF

1.7 PERFORMANCE REQUIREMENTS

Seismic-Restraint Loading:

- A. Site Class as Defined in the CBC: Refer to structural plans
- B. Assigned Seismic Use Group or Building Category as Defined in the CBC: Refer to structural plans
 - 1. Component Importance Factor: Refer to structural plans
 - 2. Component Response Modification Factor: Refer to structural plans
 - 3. Component Amplification Factor: Refer to structural plans
- C. Mapped Spectral Acceleration for Short Period (0.2 Second): S_S Refer to structural plans
- D. Site Coefficient for Short Period: F_a Refer to structural plans
- E. Maximum Spectral Response Acceleration for Short Period: S_{MS} Refer to structural plans
- F. Design Spectral Response Acceleration for Short Period: S_{DS} Refer to structural plans
- G. Mapped Spectral Acceleration for 1 Second Period: S_1 Refer to structural plans
- H. Site Coefficient for 1 Second Period: F_v Refer to structural plans
- I. Maximum Spectral Response Acceleration for 1 Second Period: S_{M1} Refer to structural plans
- J. Design Spectral Response Acceleration for 1 Second Period: S_{D1} Refer to structural plans

1.8 QUALIFICATIONS OF TESTING AGENCY

The testing agency shall meet the following requirements:

- A. Federal OSHA criteria for accreditation of testing laboratories, Standard Number 1910.7 (Definition and Requirements for a nationally recognized testing laboratory). Membership in the National Electrical Testing Association constitutes proof of meeting such criteria.
- B. Acceptable to authorities having jurisdiction.

PART 2 – PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Pads:
 - 1. Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 2. Resilient Material: Oil and water resistant, waffle embossed neoprene.
- B. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- C. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

- A. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency meeting requirements of Part 1.6.
- B. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four (verify with structural engineer) times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.
- F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchors and studs.
- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- I. Mounting, Anchoring, and Attachment Components: Refer to Section 260529.

- J. Steel parts shall be hot dipped galvanized after fabrication for dry areas or stainless steel for damp or wet locations.

PART 3 – EXECUTION

3.1 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency meeting requirements of Part 1.6.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
 - 1. Install restrained isolators on electrical equipment.
 - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 3. Install seismic-restraint devices using methods approved by an agency meeting requirements of Part 1.6 providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.4 FIELD QUALITY CONTROL

Tests and Inspections:

- A. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
- B. Test at least 10% of each type and size of installed anchors and fasteners selected by Architect.
- C. Test to 90 percent of rated proof load of device.
- D. Measure isolator restraint clearance.
- E. Measure isolator deflection.
- F. Verify snubber minimum clearances.
- G. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- H. Remove and replace malfunctioning units and retest as specified above.
- I. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.6 ELECTRICAL VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

- A. Provide the owner with a schedule of all major supported or suspended electrical equipment. Include the following.
 1. Equipment Location
 2. Pads:
 - a. Material
 - b. Thickness
 - c. Durometer
 - d. Number of Pads
 3. Isolator Type
 4. Component Importance Factor
 5. Component Response Modification Factor
 6. Component Amplification Factor

- B. Provide the owner with cut sheets for all other support equipment.

END OF SECTION

SECTION 260800 COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A Testing in conformity with equipment applicable to this project, applicable codes and authorities having jurisdiction
- B Test equipment requirements listed in this section shall apply to testing required by all other sections in Division 26, Division 27, and Division 28.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A Division 1
 - 1 Section 013000: Administrative Requirements
 - 2 Section 013300: Submittal Procedures
 - 3 Section 014000: Quality Requirements
 - 4 Section 016000: Product Requirements
 - 5 Section 017000: Execution and Closeout Requirements
 - 6 All other included sections under Division 1
- B All included sections under Division 26
- C All included sections under Division 27
- D All included sections under Division 28
- E Plans
- F Manufacturers' manuals, product bulletins, etc.

1.3 REFERENCE STANDARDS AND CODES

- A Published specifications standards, tests or recommended methods of trade, industry or government organizations apply to work in this section as cited in Section 260000.
- B California Electrical Code
- C International Electrical Testing Association (NETA)
 - 1 NETA ATS: for Acceptance Testing Specifications for Electrical Power Equipment and Systems
- D Institute of Electrical and Electronic Engineers
 - 1 IEEE 81: Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
 - 2 IEEE 82: Standard Test Procedure for Impulse Voltage Tests on Insulated Conductors
 - 3 IEEE 95: Standard Test Procedure for Impulse Voltage Tests on Insulated Conductors
 - 4 IEEE 112: Standard Test Procedure for Polyphase Induction Motors and Generators
 - 5 IEEE 114: Standard Test Procedure for Single-Phase Induction Motors
 - 6 IEEE 115: IEEE Guide for Test Procedures for Synchronous Machines Part I—Acceptance and Performance Testing Part II—Test Procedures and Parameter Determination for Dynamic Analysis
 - 7 IEEE 141: Recommended Practice for Electric Power Distribution for Industrial Plants

- 8 IEEE 142: Recommended Practice for Grounding of Industrial and Commercial Power Systems
 - 9 IEEE 241: Recommended Practice for Electric Power Systems in Commercial Buildings
 - 10 IEEE 242: Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (IEEE Buff Book)
 - 11 IEEE 252: Standard Test Procedure for Polyphase Induction Motors Having Liquid in the Magnetic Gap
 - 12 IEEE 259: Standard Test Procedure for Evaluation of Systems of Insulation for Dry-Type Specialty and General-Purpose Transformers
 - 13 IEEE 389: Recommended Practice for Testing Electronics Transformers and Inductors
 - 14 IEEE 393: Test Procedures for Magnetic Cores
 - 15 IEEE 399: Recommended Practice for Industrial and Commercial Power Systems Analysis (Brown Book)
 - 16 IEEE 400: Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems Rated 5 kV and Above
 - 17 IEEE 442: Guide for Soil Thermal Resistivity Measurements
 - 18 IEEE 495: Guide for Testing Faulted Circuit Indicators
 - 19 IEEE 576: Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications
 - 20 IEEE 1188: Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications
 - 21 IEEE 1234: Guide for Fault Locating Techniques on Shielded Power Cable Systems
 - 22 IEEE 1415: Guide for Induction Machinery Maintenance Testing and Failure Analysis
 - 23 IEEE 1458: Recommended Practice for the Selection, Field Testing, and Life Expectancy of Molded Case Circuit Breakers for Industrial Applications
- E National Institute of Standards and Technology (NIST)
- F Underwriters' Laboratories
- 1 UL 1244: Electrical and Electronic Measuring and Testing Equipment
 - 2 UL 1436: Outlet Circuit Testers and Similar Indicating Devices
 - 3 UL 61010-2-030: Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-030: Particular requirements for testing and measuring circuits
 - 4 UL 61010B-1: Electrical Measuring and Test Equipment – Part 1: General Requirements
 - 5 UL 61010B-2-031: Electrical Equipment for Measurement, Control, and Laboratory Use – Part 2: Particular Requirements for Hand-Held Probe Assemblies for Electrical Measurement and Test
 - 6 UL 61010B-2-032: Electrical Equipment for Measurement, Control, and Laboratory Use – Part 2: Particular Requirements for Hand-Held Current Clamps for Electrical Measurement and Test

1.4 QUALITY ASSURANCE

- A The Contractor shall engage and pay for the services of a recognized independent testing laboratory for the purpose of performing inspections and tests as herein specified.
- B The testing laboratory shall provide all material, equipment, labor and technical supervision to perform switch tests and inspections.
- C It is the intent of these tests to assure that all electrical equipment, both Contractor and Owner supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.
- D The tests and inspections shall determine the suitability for energizing.
- E Schedule tests and give a minimum of two weeks advance notice to the Owner.

1.5 SUBMITTALS

- A List of tests performed
- B Test procedures
- C Test results
- D The submittal shall be substantially complete for all items and equipment furnished under this section.
- E Individual drawings and data sheets submitted at random intervals will not be accepted for review.

1.6 QUALIFICATIONS OF TESTING AGENCY

The testing agency shall meet federal OSHA criteria for accreditation of testing laboratories, Standard Number 1910.7 (Definition and Requirements for a nationally recognized testing laboratory). International Electrical Testing Association (NETA) accreditation constitutes proof of meeting such criteria.

1.7 TEST INSTRUMENT TRACEABILITY

- A The testing laboratory shall have a calibration program which maintains all applicable test instrumentation within rated accuracy.
- B The accuracy shall be traceable to the National Institute of Standards and Technology (NIST) in an unbroken chain.
- C Instruments shall be calibrated in accordance with the following frequency schedule:
 - 1 Field instruments: 6 months maximum.
 - 2 Laboratory instruments: 12 months.
 - 3 Leased specialty equipment: 12 months
- D Dated calibration labels shall be visible on all test equipment.

1.8 FINAL SETTINGS

- A The test report shall include the following: summary of project, description of equipment tested, description of test, list of test equipment used in calibration and calibration date, test results, conclusions and recommendations, and appendix, including appropriate test forms.
- B The test report shall be bound and its contents certified.

- C Submit three copies of the completed report to the architect, or engineer if no architect is involved, no later than fifteen (15) days after completion of test, unless otherwise directed.

1.9 FAILURE TO TEST

- A Any system material or workmanship which is found defective on the basis of acceptance tests shall be reported directly to the architect or engineer if no architect is involved.
- B Contractor shall replace the defective material or equipment and have test repeated until test proves satisfactory without additional cost to the Owner.

PART 2 – PRODUCTS: [NOT USED]

PART 3 – EXECUTION

3.1 GROUND RESISTANCE TEST

- A Building ground electrode resistance testing shall be accomplished with a ground resistance, direct-reading, single test meter utilizing the Fall-of-Potential method and two (2) referenced electrodes. Perform test prior to interconnection to other grounding system. Orient the concrete-encased ground electrode to be tested and the two referenced electrodes in straight line spaces fifty (50) feet apart. Drive the two (2) reference electrodes ten (10) feet deep.
- B Test results shall be in writing, and shall show temperature, humidity and condition of the soil at the time of the tests. In the case where the ground resistance exceeds 25 ohms, add an additional ground rod and retest. Add additional ground rods when necessary in order to bring the ground resistance below 25 Ohms. All testing shall be done prior to concrete pour and in the presence of the inspector of record. Provide test results for engineer review.

3.2 MISCELLANEOUS TESTING

- A Functional and operational testing to the fire alarm, security system, telephone system, paging/intercom system, and all electrical components upon completion of electrical work.
- B Perform an insulation resistance test on all switchboard busses, bus ducts; feeder conductors, including neutrals, using a megohmmeter. Minimum value for each conductor shall be 20 megohms.

3.3 ELECTRICAL DISTRIBUTION EQUIPMENT OPERATIONAL CHECK

- A Electrical distribution equipment operational check includes main switchboards, distribution boards, panelboards, panels, switchgear, etc.
- B Verify proper operating condition of all equipment mechanically and electrically including, but not limited to verifying operation of each circuit breaker trip device with a rating of 100A or more using an accurately metered timed instrument (by passing 300% rated current through each pole).

- C If any equipment is found defective during operational check, it shall be replaced by the Contractor without cost to the Owner. The tests shall be repeated by the Contractor without cost to the owner until satisfactory results are obtained.

END OF SECTION

SECTION 262416 PANELBOARDS

PART 1 – GENERAL

1.1 SECTION INCLUDES

Lighting and Appliance Panelboards

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A Division 1
 - 1 Section 013000: Administrative Requirements
 - 2 Section 013300: Submittal Procedures
 - 3 Section 014000: Quality Requirements
 - 4 Section 016000: Product Requirements
 - 5 Section 017000: Execution and Closeout Requirements
 - 6 All other included sections under Division 1
- B All included sections under Division 26
- C All included sections under Division 27
- D All included sections under Division 28
- E Plans
- F Manufacturers' manuals, product bulletins, etc.

1.3 REFERENCE STANDARDS AND CODES

- A Published specifications standards, tests or recommended methods of trade, industry or government organizations apply to work in this section as cited in Section 260000.
- B California Electrical Code
- C California Building Code
- D Institute of Electrical and Electronic Engineers (IEEE)
 - 1 IEEE 81: Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
 - 2 IEEE 100: The Authoritative Dictionary of IEEE Standards Terms
 - 3 IEEE C2 National Electrical Safety Code
 - 4 IEEE C12.16: Solid-State Electricity Meters
 - 5 IEEE C37.13: Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures
 - 6 IEEE C37.20.1: Standard for Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
 - 7 IEEE C37.90.1: Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
 - 8 IEEE C57.12.28: Standard for Pad-Mounted Equipment - Enclosure Integrity
 - 9 IEEE C57.13: Standard Requirements for Instrument Transformers
- E National Electrical Manufacturers' Association
 - 1 NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum)
 - 2 NEMA PB 2: Deadfront Distribution Switchboards
 - 3 NEMA PB 2.1: General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 V or Less

- 4 NEMA ST 20: Standard for Dry-Type Transformers for General Applications
- 5 NEMA 12.10: Physical Aspects of Watthour Meters - Safety Standards
- F National Electrical Testing Association (NETA)
 - 1 NETA ATS: Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
- G Underwriters' Laboratories (UL)
 - 1 UL 50: Enclosures for Electrical Equipment, Non-environmental Considerations
 - 2 UL 50E: Enclosures for Electrical Equipment, Environmental Considerations
 - 3 UL 467: Grounding and Bonding Equipment
 - 4 UL 486A: Wire Connectors
 - 5 UL 486B: Wire Connectors
 - 6 UL 486E: Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
 - 7 UL 489: Molded Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures
 - 8 UL 891: Switchboards
 - 9 UL 1053: Ground-fault Sensing and Relaying Equipment
 - 10 UL 1059: Terminal Blocks
 - 11 UL 1558: Standard for Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear
 - 12 UL 2735: Electric Utility Meters
 - 13 UL 60947-1: Low-Voltage Switchgear and Controlgear – Part 1: General Rules
 - 14 UL 60947-7-1: Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment - Terminal blocks for copper conductors
 - 15 UL 60947-7-2: Low-Voltage Switchgear and Controlgear - Part 7-2: Ancillary Equipment - Protective Conductor Terminal Blocks for Copper Conductors

1.4 QUALITY ASSURANCE

- A Equipment and accessories shall be the product of a manufacturer regularly engaged in its manufacture.
- B Supply equipment and accessories new, free from defects.
- C Supply equipment and accessories in compliance with the applicable standards listed in Article 1.3 of this section and with applicable national, state and local codes.
- D Items of a given type shall be the products of the same manufacturer.
- E Ship equipment in its original packages to prevent damaging or entrance of foreign matter. Perform handling and shipping in accordance with manufacturer's recommendations. Provide protective covering during construction.
- F Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by the engineer.
- G Tag items with a weatherproof tag identifying equipment by name and purchase order number. Include packing and shipping lists.

1.5 SUBMITTALS

- A Submit under provisions of Section 013000 or 013300.
- B Submittals shall include the following:
 - 1 Table of contents
 - 2 A complete set of detailed manufacturer's specifications describing and illustrating all standard and special components and materials
 - 3 Part numbers
 - 4 Evidence of compliance with the applicable standards listed under Article 1.3 of this section
 - 5 Maintenance instructions and intervals
 - 6 Calibration procedures and intervals
- C Submit shop drawings that include:
 - 1 Complete fabrication details
 - 2 Elevations and sections of enclosure(s)
 - 3 Dimensions of enclosure(s)
 - 4 Space available for conduits
 - 5 Voltage, ampacity, short circuit, and enclosure ratings
 - 6 Short circuit withstand ability of bus and lowest rated device,
 - 7 Circuit schedule showing circuit number, device description, circuit breaker frame ampere rating and trip or fuse clip ampere rating
 - 8 Termination lug size
 - 9 Feeder identification
 - 10 Single line diagram
 - 11 Include both elementary diagram and terminal to terminal wiring diagrams.
- D Electronic submittals shall be searchable
- E The submittal shall be substantially complete for all items and equipment furnished under this section.
- F Individual drawings and data sheets submitted at random intervals will not be accepted for review.
- G Substitutions: Items of same function and performance shall be in conformance with Division 1. The Contractor shall provide a comparison of the proposed substitute with the specified equipment for review by the Engineer.
- H Submit field test and operations check report for circuit breakers under provisions of Section 260500.

1.6 OPERATION AND MAINTENANCE MANUALS

- A Submit operation and maintenance manuals in accordance with Section 260000.
- B The manuals shall, at minimum, include the following:
 - 1 Manufacturer (including contact information)
 - 2 Model number
 - 3 Manufacturer's data sheets – When data sheets include more than one model the model(s) used shall be noted
 - 4 Manufacturer's user and maintenance manual(s), including trouble-shooting guidelines
 - 5 Configuration settings
 - 6 Wiring diagrams
 - 7 Voltage ratings
 - 8 Current ratings
 - 9 List of capabilities

- 10 Environmental ratings
- 11 NEMA enclosure type
- 12 Maintenance requirements
- 13 Installation instructions
- 14 Repair instructions
- C Provide manuals in one of the following formats
 - 1 Three hardcopies
 - 2 PDF

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A Square D Company
 - 1 I-LINE
 - 2 NQ
 - 3 NF
- B Equals
 - 1 General Electric
 - 2 Eaton/Cutler-Hammer
 - 3 Approved equal

2.2 TYPE NQ PANELBOARD

- A Interior
 - 1 Shall be type NQ panelboard or approved equal rated for 240V_{AC}/48V_{DC} maximum. Continuous main current ratings, as indicated on associated schedules, not to exceed 600 amperes maximum.
 - 2 Minimum short circuit current rating: 22000AIC as indicated in rms symmetrical amperes at 240V_{AC}.
 - 3 Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing rated 100-400 amperes shall be copper. Bussing shall be copper as standard construction.
 - 4 Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twistouts covering unused mounting space.
- B Main Circuit Breaker
 - 1 Main circuit breakers shall have an over-center, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40°C ambient environment. Thermal elements shall be ambient compensating above 40°C.
 - 2 Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker which allows the user to simultaneously select the desired trip level of all poles.

- Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
- 3 Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.
 - 4 Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors 90°C rated wire, sized according to the 75°C temperature rating per CEC Table 310-16.
- C Enclosures
- 1 Type 1 Boxes
 - a Boxes shall be galvanized steel constructed in accordance with UL 50 requirements.
 - b Boxes shall have removable end walls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
 - c Box width shall be 20 in wide.
 - 2 Type 1 Fronts
 - a Front shall meet strength and rigidity requirements per UL 50 standards.
 - b Front shall have cylindrical tumbler type lock with catch and spring-loaded stainless steel door pull. All lock assemblies shall be keyed alike. Two (2) keys shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
 - c All electrical busses shall be copper.
 - 3 Type 3R, 5, and 12
 - a Enclosures shall be constructed in accordance with UL 50 requirements
 - b All doors shall be gasketed and equipped with a tumbler type vault lock. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
 - c Maximum enclosure dimensions shall not exceed 20 in wide and 6.5 in deep.

2.3 TYPE NF PANELBOARD

- A Interior
- 1 Shall be type NF panelboard for 480Y/277V_{AC} maximum. Continuous main current ratings, as indicated on associated schedules, not to exceed 600 amperes maximum.
 - 2 Minimum Short Circuit Rating: 14000 as indicated rms symmetrical amperes at 480Y/277V_{AC}.
 - 3 Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors limited to bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing rated 100-400 amperes shall be copper. Bussing rated for 600 amperes shall be copper as standard construction.
 - 4 Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twistouts covering unused mounting space.

- B Main Circuit Breaker
 - 1 Main circuit breakers shall have an over-center, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40°C ambient environment. Thermal elements shall be ambient compensating above 40°C.
 - 2 Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the breaker which allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
 - 3 Circuit breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.
 - 4 Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 90°C rated wire, sized according to the 75°C temperature rating per CEC Table 310-16.
- C Enclosures
 - 1 Type 1 Boxes
 - a Boxes shall be galvanized steel constructed in accordance with UL 50 requirements.
 - b Boxes shall have removable end walls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
 - 2 Type 1 Fronts
 - a Front shall meet strength and rigidity requirements per UL 50 standards.
 - b Front shall have flat latch type lock with catch and spring loaded stainless steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
 - 3 Type 3R, 5, and 12
 - a Enclosures shall be constructed in accordance with UL 50 requirements
 - b All doors shall be gasketed and equipped with a tumbler type vault lock and two (2) additional trunk type latches. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory card holder shall be mounted on the inside of door.
 - c Maximum enclosure dimensions shall not exceed 21 inches wide and 8 inches deep.

2.4 ENCLOSURE FINISH

- A The completed enclosure shall be degreased and cleaned.
- B After the cleaning process is finished, the enclosure shall be phosphatized.
- C After the phosphatizing, the enclosure shall receive an electrostatic deposition of polyester powder coating followed by baking to produce a hard durable finish.
 - 1 The minimum thickness of the paint film shall be 2.0 mils.
 - 2 For the exterior of transformer tank, interior and exterior of primary and secondary cable compartments the minimum total dry film thickness shall be 3.5 mils.
 - 3 Paint film shall be uniform in color and free from blisters, sags, flaking and peeling
- D Finish shall conform to UL 50 and UL 50E.
- E Color shall be ANSI 61 Gray.
- F Coat underside surfaces of equipment outdoors or in damp locations with a corrosion resistant coating.

2.5 NAMEPLATES

Provide and install nameplates per Section 260500.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install all equipment per manufacturers' instructions.
- B. Test all equipment per manufacturer's instructions.
- C. Mount panelboards with center of top circuit breaker handle no higher than 78" above finished floor. Install flush mounted panelboards as indicated on architectural interior elevation drawings. Provide all necessary blocking, channels and other hardware for securing panelboards to wall, column or other parts of building structure.
- D. Submit three copies of the certified list for permanent record to be referenced to in the event of failure of any motor either within or beyond expiration of the warranty period.

3.2 GROUNDING

- A. Ground equipment per manufacturer's instructions, Section 260500, and applicable codes.
- B. Minimize resistance from device to ground.
- C. Resistance from device to ground shall not exceed 25 ohms.

3.3 LOAD BALANCING

If the contractor changes circuiting from the panel schedule on the approved plans, the contractor shall be responsible to ensure that the loads on any two phases differ by no more than 5%.

3.4 IDENTIFICATION

- A Provide nameplate identifying panel on exterior of panel per requirements in Section 260500.
- B Provide type written panel schedule on interior of door.

END OF SECTION

SECTION 262700 – LOW VOLTAGE (0-600V) DISTRIBUTION EQUIPMENT

PART 1 – GENERAL

1.1 SECTION INCLUDES

Materials, equipment fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction, for the following:

- A Wiring devices
- B Terminal cabinets
- C Power distribution terminal blocks

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A Division 1
 - 1 Section 013000: Administrative Requirements
 - 2 Section 013300: Submittal Procedures
 - 3 Section 014000: Quality Requirements
 - 4 Section 016000: Product Requirements
 - 5 Section 017000: Execution and Closeout Requirements
 - 6 All other included sections under Division 1
- B All included sections under Division 26
- C All included sections under Division 27
- D All included sections under Division 28
- E Plans
- F Manufacturers' manuals, product bulletins, etc.

1.3 REFERENCE STANDARDS

Published specification standards, tests or recommended methods of trade, industry or government organizations apply to work in this section as cited in Section 260000.

- A California Building Code
- B California Electrical Code
- C Underwriters' Laboratories
 - 1 UL 20: General Use Snap Switches
 - 2 UL 50: Enclosures for Electrical Equipment, Non-environmental Considerations
 - 3 UL 50E: Enclosures for Electrical Equipment, Environmental Considerations
 - 4 UL 111: Multi-Outlet Assemblies
 - 5 UL 231: Power Outlets
 - 6 UL 486A: Wire Connectors
 - 7 UL 486B: Wire Connectors
 - 8 UL 486E: Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
 - 9 UL 498: Attachment Plugs and Receptacles
 - 10 UL 514A: Metallic Outlet Boxes
 - 11 UL 514C: Nonmetallic Outlet Boxes, Flush-device Boxes, and Covers
 - 12 UL 514D: Cover Plates for Flush-mounted Wiring Devices
 - 13 UL 917: Clock Operated Switches
 - 14 UL 943: Ground Fault Circuit Interrupters
 - 15 UL 1681: Wiring Devices Configurations

- 16 UL 1773: Standard for Termination Boxes
- 17 UL 1953: Power Distribution Terminal Blocks
- 18 UL 2255: Standard for Receptacle Closures
- 19 UL 2682: Switch Rated Plugs and Receptacles

1.4 QUALITY ASSURANCE

- A Equipment and accessories shall be the product of a manufacturer regularly engaged in its manufacture.
- B Supply equipment and accessories new, free from defects.
- C Equipment and accessories in compliance with the applicable standards listed in Article 1.3 of this section and with applicable national, state and local codes.
- D Items of a given type shall be the products of the same manufacturer.
- E Deliver, store and protect products under provisions of Section 016200.
- F Ship equipment in its original packages, to prevent damaging or entrance of foreign matter. Perform handling and shipping in accordance with manufacturer's recommendations. Provide protective covering during construction.
- G Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by the engineer.
- H Tag items with a weatherproof tag identifying equipment by name and purchase order number. Include packing and shipping lists.

1.5 SUBMITTALS

- A Submit under provisions of Section 013000 or 013300.
- B Submittals shall include the following:
 - 1 Table of contents
 - 2 A complete set of detailed manufacturer's specifications describing and illustrating all standard and special components and materials
 - 3 Part numbers
 - 4 Evidence of compliance with the applicable standards listed under Article 1.3 of this section
 - 5 Maintenance instructions and intervals
 - 6 Calibration procedures and intervals
 - 7 A complete set of drawings for any special items
 - 8 A single line block diagram showing exactly the manner in which the contractor proposes to layout the system.
 - 9 Wiring diagrams
 - 10 Illustrations and scale drawing of the racks, equipment layouts etc.
 - 11 Drawings shall include designations, dimensions, operating controls, instruments, riser diagrams, routing diagrams etc.
 - 12 The contractor shall also submit a copy of his valid state contractor's license and show proof that he is a distributor of the submitted equipment.
- C Electronic submittals shall be searchable
- D The submittal shall be substantially complete for all items and equipment furnished under this section.
- E Individual drawings and data sheets submitted at random intervals will not be accepted for review.
- F Substitutions: Items of same function and performance shall be submitted in conformance with Division 1.

1.6 OPERATION AND MAINTENANCE MANUALS

- A Submit operation and maintenance manuals in accordance with Section 260000.
- B The manuals shall, at minimum, include the following:
 - 1 Manufacturer (including contact information)
 - 2 Model number
 - 3 Manufacturer's data sheets – When data sheets include more than one model the model(s) used shall be noted
 - 4 Manufacturer's user and maintenance manual(s), including trouble-shooting guidelines
 - 5 Configuration settings
 - 6 Wiring diagrams
 - 7 Voltage ratings
 - 8 Current ratings
 - 9 List of capabilities
 - 10 Environmental ratings
 - 11 NEMA enclosure type
 - 12 Maintenance requirements
 - 13 Installation instructions
 - 14 Repair instructions
- C Provide manuals in one of the following formats
 - 1 Three hardcopies
 - 2 PDF

PART 2 – PRODUCTS

2.1 WIRING DEVICES

- A Wall (Local) Switches
 - 1 Totally enclosed
 - 2 AC rated
 - 3 20A rated
 - 4 Silent type, unless noted otherwise on the plans
 - 5 Manufacturers
 - a Hubbell Premise Wiring
 - b Leviton
 - 6 Specification Grade
- B Receptacles
 - 1 Duplex receptacles shall be 20A, 125V_{AC} rated, 3-wire, grounded
 - 2 Receptacle shall include a LED that indicates it has power.
 - 3 Receptacles shall be tamperproof.
 - 4 Manufacturers
 - a Hubbell Premise Wiring
 - b Leviton
 - 5 Specification Grade
 - 6 Exterior receptacle plates shall have steel, weatherproof, vandal-resistant while-in-use cover with key lockable/locking cover with keys to match owner standards.
 - 7 All automatically switched receptacles shall be marked per 2016 CEC 406.3(E).
- C Other special purpose receptacles shown on Drawings shall be of same quality.

- D GFI receptacles shall self test every 3 seconds and indicate if the GFI protection has passed or failed the test.

- E Wall Plates:
 - 1 Commercial: Satin finish stainless steel
 - 2 Educational and medical: Satin finish stainless steel
 - 3 Medical: Satin finish stainless steel
 - 4 Residential:
 - a Material: Nylon
 - b Color: Match wall color

- F Switch and receptacle colors shall be as noted below unless otherwise specified.
 - 1 Job type dependant:
 - a Educational and medical: Gray
 - b Commercial: White
 - c Residential: Match wall color
 - 2 Feature type dependant (not job type dependant):
 - a Isolated Ground (IG) receptacle: Orange
 - b Equipment on emergency system: Red
 - c Receptacle with surge suppression: Blue
 - d Isolated ground receptacles with feature dependant color (other than orange) shall have orange triangle.
 - 3 Follow the facility has a color code scheme if the facility has one. Verify with owner.

2.2 TERMINAL CABINETS

- A Construction
 - 1 Fabricated from code gauge steel, size as indicated on drawings, with flush latch and concealed hinges and mounting screws.
 - 2 Enclosure for flush mounted cabinets shall be designed for flush mounting.
 - 3 Enclosure for surface mounted cabinets shall be designed for surface mounting.

- B Where size is not indicated, the minimum size shall be 24 inches wide x 30 inches high x 4 inches deep.

- C Cabinet shall be Square D "Mono-Flat Fronts", or approved equal.

- D Terminal cabinets shall include a backboard at inside back of cabinet.
 - 1 The backboard shall be 3/4" inch thick plywood
 - 2 Paint backboard with 3 coats of fire retardant paint.

- E Provide and install one terminal point for each wire within the terminal cabinet.

- F NEMA type:
 - 1 Interior, non-corrosive, non-hazardous (classified) locations: NEMA 1
 - 2 Exterior locations with vents: NEMA 3R
 - 3 Cooled enclosures: NEMA 4
 - 4 Enclosures containing electronics in dusty areas or outdoors: NEMA 4
 - 5 Enclosures in hazardous (classified) locations: NEMA 4 or 4X (corrosive locations) listed for hazardous classification
 - 6 Enclosure in corrosive locations: NEMA 4X
 - 7 All seams on NEMA 3R, 4, and 4X enclosures shall be continuously welded with welds ground smooth.

- G Coating

- 1 The completed enclosure shall be degreased and cleaned.
- 2 After the cleaning process is finished, the enclosure shall be phosphatized.
- 3 After the phosphatizing, the enclosure shall receive an electrostatic deposition of polyester powder coating followed by baking to produce a hard durable finish.
 - a The minimum thickness of the paint film shall be 2.0 mils.
 - b For the exterior of transformer tank, interior and exterior of primary and secondary cable compartments the minimum total dry film thickness shall be 3.5 mils.
 - c Paint film shall be uniform in color and free from blisters, sags, flaking and peeling
- 4 Finish shall conform to UL 50 and UL 50E.
- 5 Color shall be ANSI 61 Gray.
- 6 Coat underside surfaces of equipment outdoors or in damp locations with a corrosion resistant coating.

2.3 POWER DISTRIBUTION TERMINAL BLOCKS

- A Power distribution terminal blocks (PDTB) shall be finger-safe, NEMA 1 type.
- B Conducting material shall be copper.
- C Current rating and short circuit rating of PDTBs shall be no lower than upstream overcurrent protective device.
- D Terminals
 - 1 Each terminal shall be screw type and be designed for wire size connecting to it.
 - 2 PDTB shall have one terminal for each wire connected to it on both load and line sides.
- E Load wire sizes and OCPD shall comply with CEC 240.21(B) and 240.92(B) as well as all other applicable codes.
- F PDTBs shall have provisions for panel or DIN rail mounting.
- G PDTBs shall be mounted within enclosure unless otherwise noted.

2.4 NAMEPLATES

Provide and install nameplates per Section 260500.

PART 3 – EXECUTION

3.1 GENERAL

- A Electric system layouts indicated on the Drawings are generally diagrammatic, but shall be followed as closely as actual construction and work of other trades will permit. Govern exact routing of cable and wiring and the locations of outlets by the structure and equipment served. Dimensions shall be taken from Architectural Drawings.
- B Consult all other Drawings. Verify scales and report any dimensional discrepancies or other conflicts to architect, or engineer if no architect is involved, before submitting bid.
- C Home runs to panelboards are indicated as starting from the outlet nearest the panel and continuing in the general direction of that panel. Continue such circuits to the

- panel as though the routes were completely indicated. Terminate homeruns of signal, alarm, and communications system in a similar manner.
- D Avoid cutting and boring holes through structure or structural members wherever possible. Obtain prior approval of Architect and conform to structural requirements when cutting or boring the structure is necessary or permitted.
 - E Furnish and install necessary hardware, hangers, blocking, brackets, bracing, runners, required for equipment specified under this section.
 - F Provide necessary backing required to insure rigid mounting of outlet boxes.
 - G Outlet boxes shall be plumb.
 - H Back of wall plates shall be flush with wall finish. Gaps between wall plates and wall or wall plates not parallel to wall are not acceptable.

3.2 CONNECTIONS TO EQUIPMENT

- A General:
 - 1 Furnish and install required power supply conduit and wiring to equipment. See below for other wiring required.
 - 2 Install rough-in work for equipment from approved shop drawings to suit the specific requirements of the equipment.
 - 3 Furnish and install magnetic motor starters that are shown on the Drawings or specified under other divisions to be furnished under this division of work. Verify equipment nameplate ratings prior to installation and furnish adequately rated starters for the loads.
 - 4 Furnish and install manual thermal protection for motors not integrally equipped with thermal protection.
 - 5 Furnish and install 120V power to each control panel and time switch requiring a source of power to operate.
- B Heating, ventilating, and air conditioning equipment:
 - 1 Coordinate with mechanical contractor for sizes, locations and details of motors, heating units, and control requirements.
 - 2 Provide required power supply conduit and wiring to equipment.
 - 3 Provide a suitable means of disconnect switch immediately ahead of and adjacent to each motor and appliance unless the motor or appliance is located adjacent and within sight of the service panelboard, circuit breaker or switch at a distance allowed by codes. Verify equipment nameplate current ratings prior to installation. Provide a disconnect means at each magnetic motor starter.
 - 4 Provide magnetic motor starters required under this division of work.
 - 5 Provide manual thermal protection for motors not integrally equipped with thermal protection.
 - 6 Line and low voltage temperature control and interlock wiring, conduit, and required connections are a part of other divisions unless specifically shown or noted on the Drawings as to be furnished under this section.
 - 7 Provide 120V power supply to control panels, time switch furnished and installed under other divisions of work.
 - 8 Furnish and install 120V power to each duct detector scheduled for operation of fire dampers or shut down of mechanical equipment. Coordinate the exact quantity and locations with the mechanical drawings.

- C Plumbing and other contractor-furnished and Owner-furnished equipment:
- 1 Required power and control conduit, wiring and connections are included under this section of the work. Control sensing and alarm devices will be furnished under the respective section of the contract supplying the equipment unless noted otherwise. These devices will be located in pipes, ducts, vessels, tanks, etc., and will be mounted in a place by the Contractor furnishing the devices. Other devices shall be mounted under this section of the work.
 - 2 Control panels for packaged equipment will be furnished under the respective section of the contract supplying the equipment unless otherwise noted. Installation and connection of the control panels are under this section of the work.

3.3 IDENTIFICATION

Refer to Section 260500.

END OF SECTION

SECTION 262800 – LOW VOLTAGE (0-600V) CIRCUIT PROTECTIVE DEVICES

PART 1 – GENERAL

1.1 SECTION INCLUDES

Materials, equipment fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction, for overcurrent protective devices

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A Division 1
 - 1 Section 013000: Administrative Requirements
 - 2 Section 013300: Submittal Procedures
 - 3 Section 014000: Quality Requirements
 - 4 Section 016000: Product Requirements
 - 5 Section 017000: Execution and Closeout Requirements
 - 6 All other included sections under Division 1
- B All included sections under Division 26
- C All included sections under Division 27
- D All included sections under Division 28
- E Plans
- F Manufacturers' manuals, product bulletins, etc.

1.3 REFERENCE STANDARDS AND CODES

Published specification standards, tests or recommended methods of trade, industry or government organizations apply to work in this section as cited in Section 260000.

- A California Building Code
- B California Electrical Code
- C Institute of Electrical and Electronic Engineers
 - 1 IEEE 1015: Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems
 - 2 IEEE 1458: Recommended Practice for the Selection, Field Testing, and Life Expectancy of Molded Case Circuit Breakers for Industrial Applications
- D Underwriters' Laboratories
 - 1 UL 50: Enclosures for Electrical Equipment, Non-environmental Considerations
 - 2 UL 50E: Enclosures for Electrical Equipment, Environmental Considerations
 - 3 UL 98: Enclosed and Dead-front Switches
 - 4 UL 244A: Solid-state Controls for Appliances
 - 5 UL 363: Knife Switches
 - 6 UL 489: Molded-case Circuit Breakers, Molded-case Switches, and Circuit Breaker Enclosures
 - 7 UL 1066: Standard for Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures
 - 8 UL 2367: Standard for Solid State Overcurrent Protectors
 - 9 UL 60947-7-3: Low-Voltage Switchgear and Controlgear - Part 7-3: Ancillary Equipment - Safety Requirements for Fuse Terminal Blocks

1.4 QUALITY ASSURANCE

- A Equipment and accessories shall be the product of a manufacturer regularly engaged in its manufacture.
- B Supply equipment and accessories new, free from defects.
- C Equipment and accessories in compliance with the applicable standards listed in Article 1.3 of this section and with applicable national, state and local codes.
- D Items of a given type shall be the products of the same manufacturer.
- E Deliver, store and protect products under provisions of Section 016200.
- F Ship equipment in its original packages, to prevent damaging or entrance of foreign matter. Perform handling and shipping in accordance with manufacturer's recommendations. Provide protective covering during construction.
- G Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by the engineer.
- H Tag items with a weatherproof tag identifying equipment by name and purchase order number. Include packing and shipping lists.

1.5 SUBMITTALS

- A Submit under provisions of Section 013000 or 013300.
- B Submittals shall include the following:
 - 1 Table of contents
 - 2 A complete set of detailed manufacturer's specifications describing and illustrating all standard and special components and materials
 - 3 Part numbers
 - 4 Evidence of compliance with the applicable standards listed under Article 1.3 of this section
 - 5 Maintenance instructions and intervals
 - 6 A complete set of drawings for any special items
 - 7 Wiring diagrams
- C Electronic submittals shall be searchable
- D The submittal shall be substantially complete for all items and equipment furnished under this section.
- E Individual drawings and data sheets submitted at random intervals will not be accepted for review.
- F Substitutions: Items of same function and performance shall be submitted in conformance with Division 1.

1.6 OPERATION AND MAINTENANCE MANUALS

- A Submit operation and maintenance manuals in accordance with Section 260000.
- B The manuals shall, at minimum, include the following:
 - 1 Manufacturer (including contact information)
 - 2 Model number
 - 3 Manufacturer's data sheets – When data sheets include more than one model the model(s) used shall be noted
 - 4 Manufacturer's programming, user, and maintenance manual(s), including trouble-shooting guidelines
 - 5 Configuration settings
 - 6 Wiring diagrams
 - 7 Voltage ratings

- 8 Current ratings
- 9 Calibrated range
- 10 List of capabilities
- 11 Environmental ratings
- 12 NEMA enclosure type
- 13 Maintenance requirements
- 14 Installation instructions
- 15 Repair instructions
- C Provide manuals in one of the following formats
 - 1 Three hardcopies
 - 2 PDF

PART 2 – PRODUCTS

2.1 CIRCUIT BREAKERS

- A Circuit breakers shall be constructed in accordance with the following standards:
 - 1 UL 489 or UL 1066
 - 2 Federal Specification W-C-375B/GEN
 - 3 NEMA AB1
 - 4 CSA 22.2, No. 5-M91
 - 5 IEC 157-1
 - 6 BS 4752
- B Construction
 - 1 Circuit breakers shall be constructed using glass reinforced polyester insulating material providing superior dielectric strength.
 - 2 Current-carrying components shall be completely isolated from the handle and the accessory mounting area.
 - 3 Breaker contact material shall be a non-weldable silver alloy.
 - 4 Breakers shall have arc-extinguishing chutes.
 - 5 Circuit breakers shall have an over-center, trip-free, toggle operating mechanism which will provide quick-make, quick-break contact action.
 - 6 Multiple pole breakers shall have a common trip element and a single operating handle.
 - 7 Circuit breakers for branch circuits shall be molded case
 - 8 Circuit breakers shall have bolt-on/plug-on type bus connectors.
- C Trip type
 - 1 Circuit breakers having a frame size of 150 amperes or less shall have thermal magnetic non-interchangeable, trip-free sealed trip units.
 - 2 Circuit breakers with a frame size of 175 amperes to 1200 amperes shall have interchangeable thermal and adjustable magnetic trip elements.
- D There shall be two forms of visible trip indication.
 - 1 The breaker handle shall reside in a position between ON and OFF.
 - 2 In addition, there shall be a red trip indicator appearing in the clear window of the circuit breaker housing.
- E Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the panelboard schedules.
- F Circuit breakers faceplates shall be marked with the following
 - 1 Rated ampacity
 - 2 UL and IEC certification standards
 - 3 Applicable voltage systems and corresponding AIR ratings

- G Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 90°C rated wire, sized according to the 75°C temperature rating per CEC Table 310-16.
- H Branch circuit breakers rated 30 amperes and below shall be UL Listed to accept 60°C rated wire.
- I The interrupting capacity of all main and feeder branch circuit breakers shall be a minimum of 42,000A_{RMS} symmetrical amperes.
- J All circuit breakers feeding HVAC units, motors, or circuit breakers supplying loads other than convenience receptacles or lights shall have lockout devices.
- K Standard circuit breakers up to 250A at 600V_{AC} shall be UL Listed with HACR ratings.
- L All circuit breakers feeding 120V, 15A and 20A branch circuits in dwellings shall be AFCI.
- M Circuit breakers with shunt-trip or low voltage release shall be switch duty rated.
- N All fixed trip circuit breakers 1200A or greater and adjustable trip circuits breakers with a maximum rating 1200A or greater shall be equipped with one of the following methods to reduce arc flash energy.
 - 1 Zone selective interlocking
 - 2 Differential relaying
 - 3 Arc flash detection and mitigation system in panel/board with the 1200A circuit breaker, refer to Section 260930

2.2 SAFETY SWITCHES (DISCONNECTS)

- A Switches shall be heavy duty type
- B Minimum voltage rating shall be 600V.
- C Minimum Size
 - 1 Switches for disconnecting motors shall be sized for the horsepower of for motor(s).
 - 2 All switches shall be sized per the overcurrent protective device protecting the switch.
- D Construction
 - 1 NEMA 1 for indoors
 - 2 NEMA 3R or NEMA 4 for outdoors
 - 3 Handle shall be lockable in the off/disconnected/open position.
- E The switch shall include a barrier between the fuse section and the switch section with separate doors for each section. The entire fuse section shall be de-energized when the switch is in the off position.
- F Switch shall be equivalent to Square D H-rated series.
- G Finish: The entire enclosure shall be finished as follows.
 - 1 Degreasing
 - 2 Cleaning
 - 3 Phosphatizing
 - 4 Electrostatic deposition of polymer polyester powder coating followed by baking to produce a hard, durable finish.
 - a The minimum thickness of the paint film shall be 2.0 mils.
 - b Paint film shall be uniform in color and free from blisters, sags, flaking and peeling
 - 5 Finish shall conform to UL 50 and UL 50E.
 - 6 Color shall be ANSI 61 Gray.

- 7 Coat underside surfaces of equipment outdoors or in damp locations with a corrosion resistant coating

PART 3 – EXECUTION

3.1 GENERAL

- A Electric system layouts indicated on the Drawings are generally diagrammatic but shall be followed as closely as actual construction and work of other trades will permit. Govern exact routing of cable and wiring and the locations of outlets by the structure and equipment served. Dimensions shall be taken from Architectural Drawings.
- B Consult all other Drawings. Verify scales and report any dimensional discrepancies or other conflicts to architect, or engineer if no architect is involved, before submitting bid.
- C Furnish and install necessary hardware, hangers, blocking, brackets, bracing, runners, required for equipment specified under this section.

3.2 OVER CURRENT PROTECTION DEVICE COORDINATION STUDY

- A Contractor shall provide a coordination study to determine trip settings of circuit breakers and/or appropriate fuse types. Provide an electric copy of the study to the electrical engineer in EasyPower.
- B Fault, circuit overload, etc shall only trip closest circuit breaker or melt closest fuse. No other circuits shall be affected.

3.3 ARC ENERGY REDUCTION

- A The contractor shall have an arc flash study performed. The study shall be conducted per IEEE 1584 by an electrical engineer licensed in California.
- B The contractor shall have a selective coordination study performed.
- C The Non-inhibited trip settings shall be from the arc flash study, NFPA 70E, OSHA requirements, local and state requirements, and the owner.
- D The inhibited trip settings shall be from the selective coordination study.
- E Provide an electric copy of the studies to the Electrical Engineer of Record in EasyPower.

END OF SECTION

SECTION 265000 – LIGHTING

PART 1 – GENERAL

1.1 SECTION INCLUDES

This section includes materials, equipment fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction, for lighting fixtures and installation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A Division 1
 - 1 Section 013000: Administrative Requirements
 - 2 Section 013300: Submittal Procedures
 - 3 Section 014000: Quality Requirements
 - 4 Section 016000: Product Requirements
 - 5 Section 017000: Execution and Closeout Requirements
 - 6 All other included sections under Division 1
- B All included sections under Division 26
- C All included sections under Division 27
- D All included sections under Division 28
- E Plans
- F Manufacturers' manuals, product bulletins, etc.

1.3 REFERENCE STANDARDS AND CODES

- A. Published specifications standards, tests or recommended methods of trade, industry or government organizations apply to work in this section as cited in Section 260000.
- B. California Electrical Code
- C. Illuminating Engineering Society: The Lighting Handbook
- D. Underwriters' Laboratories
 - 1. UL 50: Enclosures for Electrical Equipment, Non-environmental Considerations
 - 2. UL 50E: Enclosures for Electrical Equipment, Environmental Considerations
 - 3. UL 924: Emergency Lighting and Power Equipment
 - 4. UL 1598: Luminaires
 - 5. UL 2575: Standard for Lithium Ion Battery Systems for Use in Electric Power Tool and Motor Operated, Heating and Lighting Appliances
 - 6. UL 8750: Light Emitting Diode Equipment for Use in Lighting Products

1.4 QUALITY ASSURANCE

- A. Equipment and accessories shall be the product of a manufacturer regularly engaged in its manufacture.
- B. Supply equipment and accessories new, free from defects.
- C. Supply equipment and accessories in compliance with the applicable standards listed in Article 1.3 of this section and with applicable national, state and local codes.
- D. Items of a given type shall be the products of the same manufacturer.

- E. Ship equipment in its original packages to prevent damaging or entrance of foreign matter. Perform handling and shipping in accordance with manufacturer's recommendations. Provide protective covering during construction.
- F. Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by the engineer.
- G. Tag items with a weatherproof tag identifying equipment by name and purchase order number. Include packing and shipping lists.

1.5 SUBMITTALS

- A. Submit under provisions of Section 013000 or 013300.
- B. Submittals shall include the following:
 - 1. Table of contents
 - 2. A complete set of detailed manufacturer's specifications describing and illustrating all standard and special components and materials
 - 3. Part numbers
 - 4. Evidence of compliance with the applicable standards listed under Article 1.3 of this section
 - 5. Maintenance instructions and intervals
 - 6. Calibration procedures and intervals
 - 7. A complete set of drawings for any special items
 - 8. Wiring diagrams
 - 9. Drawings shall include designations, dimensions, operating controls, instruments, riser diagrams, routing diagrams etc.
- C. Electronic submittals shall be searchable
- D. The submittal shall be substantially complete for all items and equipment furnished under this section.
- E. Individual drawings and data sheets submitted at random intervals will not be accepted for review.
- F. Substitutions: Items of same function and performance shall be submitted in conformance with Division 1.
- G. Pole mounted fixtures, including complete data on the pole material, finish, handholes, anchoring and attachment. Support method shall be submitted for interior fixtures weighing more than fifty (50) pounds.

1.6 OPERATION AND MAINTENANCE MANUALS

- A. Submit operation and maintenance manuals in accordance with Section 260000.
- B. The manuals shall, at minimum, include the following:
 - 1. Manufacturer (including contact information)
 - 2. Model number
 - 3. Programming manual (where applicable)
 - 4. Wiring diagrams
 - 5. Trouble-shooting guidelines (where applicable)
 - 6. Voltage ratings
 - 7. Current ratings
 - 8. Calibrated range (where applicable)
 - 9. List of capabilities
 - 10. Environmental ratings
 - 11. NEMA enclosure type
 - 12. Maintenance requirements

- 13 Installation instructions
- 14 Repair instructions (where applicable)
- C Provide manuals in one of the following formats
 - 1 Three hardcopies
 - 2 PDF

PART 2 – PRODUCTS

2.1 GENERAL

- A. Furnish and install all fixtures complete, whips, conductors, etc. and ready for service.
- B. Fixture Designation: Fixtures are designated on Drawings by means of letters. See Lighting Fixture Schedule. Where only one (1) fixture designation appears in a room or area, that designation applies to all fixtures in that room or area.
- C. Tandem wired units acceptable where appropriate.
- D. Manufacturers and models for fixtures shall be as shown on the fixture schedule or approved equal.

2.2 FIXTURES

- A Linear fixtures
 - 1 Fixture housings shall be steel.
 - 2 Housing shall be painted after fabrication with white, electro-statically deposited paint. Housing shall be completely covered with paint to prevent corrosion.
- B All lenses shall be clear, prismatic, 0.125", K12 pattern, acrylic lenses.
- C Louvers shall be semi-specular aluminum.
- D Open can light reflectors shall be semi-specular aluminum.
- E Fixtures installed in gyms and similar rooms, locker rooms, storage rooms, and warehouses shall include stainless steel wireguards to protect fixture from damage.
- F Fixtures shall direct a minimum of 75% of light within zone below 30 degrees below horizontal.

2.3 DRIVERS

- A. Total harmonic distortion
- B. Dimming
- C. Lumens/watt
- D. Emergency drivers
 - 1. Minimum output of 10 Watts
 - 2. Indoor: Nickel-cadmium battery with operating range of 32°F to 131°F
 - 3. Outdoor: Nickel metal hydride with operating range of -4°F to 140°F

2.4 LED ARRAY

- A. All LEDs shall have a color rendering index (CRI) of 0.8 unless otherwise noted.
- B. All LEDs shall have a corrected color temperature (CCT) of 4000K unless otherwise noted.

- C. The minimum L70 life shall 60,000 hours. The reported L70 life shall not exceed 6 times the LM-80 test period. Testing, calculations, and reports shall comply with IES LM-80, TM-21, and TM-28.

2.5 EXIT SIGNS

- A. All exit signs shall be connected to an unswitched source.
- B. Colors
 - 1. Face shall be white.
 - 2. Letters and arrows shall be green.
- C. Exit signs shall have arrows to indicate direction of exit where necessary.
- D. All exit signs shall include batteries to provide 90 minutes of illumination in the event of a power outage.

2.6 FIXTURE HANGERS AND SUPPORTS

- A. Provide proper supports and mounting accessories, such as hangers, stems, yokes, plaster frames, etc., as required by the type of ceiling installed.
- B. Where pendant mounted fixtures with stems are specified, provide swivel canopies or ball aligners in order to hang plumb regardless of ceiling slope.
- C. Entire assemblies shall comply with state earthquake resistance/ bracing guidelines.

2.7 POLES

- A. The minimum pole shall be capable of supporting the weights and effective projected areas listed below in 100 MPH winds:
 - 1. 20 foot tall: $W_{MAX}=390\text{lbs}$, $EPA_{Max}=15.6\text{FT}^2$
 - 2. 25 foot tall: $W_{MAX}=495\text{lbs}$, $EPA_{Max}=19.8\text{FT}^2$
 - 3. 30 foot tall: $W_{MAX}=550\text{lbs}$, $EPA_{Max}=22.0\text{FT}^2$
 - 4. 35 foot tall: $W_{MAX}=363\text{bs}$, $EPA_{Max}=14.5\text{FT}^2$
 - 5. 39 foot tall: $W_{MAX}=475\text{lbs}$, $EPA_{Max}=19.0\text{FT}^2$
 - 6. 45 foot tall: $W_{MAX}=475\text{lbs}$, $EPA_{Max}=19.0\text{FT}^2$
 - 7. 50 foot tall: $W_{MAX}=340\text{lbs}$, $EPA_{Max}=13.6\text{FT}^2$
- B. Anchoring
 - 1. Concrete base depth and anchor bolt length shall be as shown on plans.
 - 2. In no case shall the concrete base embedment depth be less than 20% of the pole height.
 - 3. Minimum anchor bolt length is 10% of the pole height.
 - 4. Minimum anchor bolt diameter is 1 inch.
- C. Coordinate with architect for pole color.
- D. Poles shall be made of ATSM A595, Grade A steel.

2.8 GROUNDING

- A. Fixtures shall have factory installed grounding studs.
- B. All fixtures shall be capable of being grounded.

2.9 LIGHTING CONTROLS

Refer to Section 265700.

PART 3 – EXECUTION

3.1 GENERAL

- A. Verify ceiling type and conditions. Order fixtures designed for conditions and the type of ceiling installed.
- B. Architectural reflected ceiling plans shall be used to determine exact locations of lighting fixtures.
- C. Determine exact location and height of fixtures by the structural and mechanical limitations of the building. Install fixtures in such a manner as to avoid such obstructions and to give proper illumination result. Verify layouts with architect.
- D. All recessed lighting fixtures shall be wired from adjacent junction boxes utilizing 6' flexible metal conduit to permit future fixture relocation. Outlet box for surface or stem mounted fixtures shall be provided with fixture stud as well as tapped and drilled canopy covers. All outlets shall finish flush with walls or ceiling except where in ceiling tiles, locate these in the center of a tile or at the intersection of four (4) tiles.
- E. All building mounted fixtures shall be supported from the building structural members. Provide all necessary blocking and hardware so that fixtures installed suspended below grid type ceiling shall be supported independently of the grid system at a minimum of four (4) points per 4' long fixture.
- F. Minimum mounting provisions for closed ceiling (surface) mounted fluorescent lighting fixtures in ceilings other than grid type shall be as follows:
 - 1. 4' long fixture body: By a pair of 3/8" machine bolts separated by a maximum distance possible and located 4 inches in from each end of fixture - total of four (4) bolts per fixture.
- G. Support for fixtures installed in suspended ceilings shall conform to Section 4701 of Title 24, Part 2.
- H. When installed in grid type ceiling, a slack #12 gauge galvanized tie wire permanently attached to the structure shall be provide at four (4) corners of each 4' long fixture.
- I. At fire rated ceiling, provide sheet rock at top and at all sides of recessed mounted lighting fixtures.
- J. Ground all fixtures.

END OF SECTION

SECTION 271100 – COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 – GENERAL

1.1 SECTION INCLUDES

This section includes material and workmanship requirements for intermediate data frames (IDFs), main data frames (MDFs), and signal and communications terminal backboards (SCTBs) including, but not limited to, cabinets, racks, patch panels, cable terminations, patch cables, and power distribution.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A Division 1
 - 1 Section 013000: Administrative Requirements
 - 2 Section 013300: Submittal Procedures
 - 3 Section 014000: Quality Requirements
 - 4 Section 016000: Product Requirements
 - 5 Section 017000: Execution and Closeout Requirements
 - 6 All other included sections under Division 1
- B All included sections under Division 26
- C All included sections under Division 27
- D All included sections under Division 28
- E Plans
- F Manufacturers' manuals, product bulletins, etc.

1.3 REFERENCE STANDARDS AND CODES

- A. Governing Codes and Conflicts: If the requirements of the Construction Documents exceed those of the governing codes and regulations, then the requirements of the Construction Documents shall prevail. Where a conflict exists, the governing codes and ordinances shall supersede all other requirements.
- B. ANSI: American National Standards Institute (ANSI)
- C. CEC: California Electrical Code
- D. Electronic Components Association (ECA)
 - 1. ECA-310-E: Cabinets, Racks, Panels, and Associated Equipment
- E. Institute of Electrical and Electronic Engineers (IEEE)
 - 1. IEEE 802.3: IEEE Standard for Ethernet
 - 2. IEEE 802.3ad: Link Aggregation
 - 3. IEEE 802.3ae: 10 Gigabit Ethernet
 - 4. IEEE 802.3af: Power over Ethernet
 - 5. IEEE 802.3an: 10 Gigabit Ethernet on Twisted Pair Copper Cable (10G Base T)
 - 6. IEEE 802.3aq: 10 Gigabit Ethernet on FDDI-Grade Multimode Fiber (10G Base LRM)
 - 7. IEEE 802.3at: Enhanced Power over Ethernet
- F. Telecommunications Industries Association (TIA)
 - 1. TIA-455: General Requirements for Standard Test Procedures for Optical Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components
 - 2. TIA-472-0000: Generic Specification for Fiber Optic Cable

3. TIA-472-C000: Sectional Specification for Fiber Optic Communications Cable for Indoor Use
4. TIA-472-D000: Sectional Specification for Optical Fiber Outside Plant Communications Cables
5. TIA-472-E000: Sectional Specification for Indoor-Outdoor Optical Fiber Cable
6. TIA-472-F000: Sectional Specification for Optical Fiber Drop Cable
7. TIA-492-0000: Generic Specification for Optical Fibers
8. TIA-492-AAAD: Detailed Specification for 850-nm, Laser Optimized, 50µm Core Diameter / 125µm Cladding Diameter, Class IA Graded-Index, Multimode Optical Fibers Suitable for Manufacturing OM4 Cabled Optical Fibers
9. TIA-492-CAAB: Detailed Specification for Class IVA, Dispersion-Unshifted, Single-Mode, Optical Fibers with Low Water Peak
10. TIA-526: Standard Test Procedures for Fiber Optic Systems
11. TIA-526-2: Effective Transmitter Output Power Coupled into Single-Mode Fiber Optic Cable
12. TIA-526-14: Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
13. TIA-526-19: Optical Signal-to-Noise Ratio Measurement Procedures for Dense Wavelength – Division Multiplexed Systems
14. TIA-568-C: Commercial Building Telecommunications Standard
15. TIA-568-C.0: Generic Telecommunications Cabling for Customer Premises
16. TIA-568-C.1: Commercial Building Telecommunications Cabling Standard
17. TIA-568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standards
18. TIA-568-C.3: Optical Fiber Cabling Components Standard
19. TIA-568-C.3-1 Addendum 1: Addition of OM4 Cabled Optical Fiber and Array Connectivity
20. TIA-569-C: Commercial Building Standard for Telecommunications Pathways and Spaces
21. TIA-604: Fiber Optic Connector Intermateability Standards
22. TIA-606-B: Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
23. TIA-607-B: Commercial Building Grounding and Bonding Requirements for Telecommunications
24. TIA-758-B: Customer Owned Outside Plant Telecommunications Infrastructure Standard
25. TIA-TSB-36: Technical Systems Bulletin Additional Cable Specifications for Unshielded Twisted-Pair Cables
26. TIA-TSB-62: Informative Test methods for Fiber-Optic Fibers, Cables, Opto-Electronic Sources and Detectors, Sensors, Connecting and Terminating Devices, and Other Fiber-Optic Components
27. TIA-TSB-63: Reference Guide for Fiber Optic Test Procedures
28. TIA-TSB-149: Generic Workmanship Guidelines for Fiber Optic Connector Interoperability
29. TIA-TSB-4979: Practical Considerations for Implementation of Encircled Flux Launch Conditions in the Field

- G. Underwriters Laboratories, Inc.
1. UL 50: Enclosures for Electrical Equipment, Non-environmental Considerations
 2. UL 50E: Enclosures for Electrical Equipment, Environmental Considerations
 3. UL 489A: Circuit Breakers for Use in Communications Equipment
 4. UL 497: Protectors for Paired-conductor Communications Circuits
 5. UL 497A: Secondary Protectors for Communications Circuits
 6. UL 497B: Protectors for Data Communications and Fire Alarm Circuits
 7. UL 497C: Protectors for Coaxial Communications Circuits
 8. UL 497D: Component Secondary Protectors for Communications Circuits Used With Specified Voltage Suppression
 9. UL 497E: Protectors for Antenna Lead-In Conductors
 10. UL 1449: Surge Protective Devices
 11. UL 1651: Standard for Optical Fiber Cable
 12. UL 1655: Standard for Community-Antenna Television Cables
 13. UL 1690: Standard for Data-Processing Cable
 14. UL 1778: Uninterruptible Power Systems
 15. UL 1801: Power Distribution Centers for Communications Equipment
 16. UL 1863: Communications Circuit Accessories
 17. UL 1977: Component Connectors for Use in Data, Signal, Control, and Power Applications
 18. UL 2024: Standard for Signaling, Optical Fiber and Communications Raceways and Cable Routing Assemblies
 19. UL 2269: Optical Fiber/Communications/Signaling/Coaxial Cable Outlet Boxes
 20. UL 2416: Audio/Video, Information, and Communication Technology Equipment Cabinet, Enclosure, and Rack Systems
 21. UL 2564: Low Voltage Surge Withstand Telecommunications Overcurrent Protector Components
 22. UL 2566: Low Voltage Surge Withstand Telecommunications Fuses
 23. UL 2567: Low Voltage Surge Withstand Telecommunications Polymer Positive Temperature Coefficient Thermistor (PPTC)
 24. UL 2569: Low Voltage Surge Withstand Telecommunications Line Feed Resistor
 25. UL 2570: Low Voltage Surge Withstand Telecommunications Electronic Current Limiters
 26. UL 60950-1: Information Technology Equipment Safety – Part 1: General Requirements
 27. UL 60950-22: Information Technology Equipment - Safety - Part 22: Equipment to be Installed Outdoors
 28. UL 62368-1: Audio/video, information and communication technology equipment - Part 1: Safety requirements

1.4 QUALITY ASSURANCE

- A Contractor requirements:
- 1 The Contractor shall have successfully completed a minimum of 5 telecommunications projects of the same size and scope.
 - 2 Project Manager
 - a The Project Manager shall have successfully completed a minimum of 5 telecommunications projects of the same size and scope.

- b The contractor shall make the project manager available to the Owner/Owner's Representative before the start of this project for an interview. This person must be deemed acceptable by the Owner and/or their Representative before work can begin.
 - c Project Manager will be required to be available for scheduled on site project meetings at no additional cost to the Owner.
 - d Project Manager will be required to be available to meet on site with the Owner/Owner's representative with a minimum of 24 hours notice for non- emergency issues, and a minimum of 4 hours for emergency issues at no additional cost to the Owner.
- 3 The work performed under this specification shall be of good quality and performed in a workmanlike manner. In this context 'good quality' means the work shall meet industry technical standards and quality of appearance. The Owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.
- 4 The Contractor shall provide all necessary materials and labor for a complete, functional Telecommunications cabling infrastructure in accordance with all applicable standards and the Construction Documents.
- B** Material requirements
- 1 All material and equipment to be installed on this project will be new and free from defects.
 - 2 Equipment and accessories shall be the product of a manufacturer regularly engaged in its manufacture.
 - 3 New material shall meet the following requirements.
 - a Manufactured within one year of the installation date.
 - b Undamaged
 - c Not previously installed
 - d Delivered to jobsite in original packaging
 - e No corrosion or other degradation of material
 - f In factory condition
 - g Unmodified
 - 4 If used material or equipment has been installed on this project the Contractor shall replace said materials and/or equipment with new products at no additional cost to the Owner.
 - 5 Equipment and accessories shall be in compliance with the applicable standards listed in Article 1.3 of this section and with applicable national, state and local codes.
 - 6 Items of a given type shall be the products of the same manufacturer.
 - 7 Deliver, store and protect products under provisions of Section 016200.
 - 8 Ship equipment in its original packages, to prevent damaging or entrance of foreign matter. Perform handling and shipping in accordance with manufacturer's recommendations. Provide protective covering during construction.
 - 9 Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by the engineer.
 - 10 Tag items with a weatherproof tag identifying equipment by name and purchase order number. Include packing and shipping lists.

- C Contractor shall warranty all materials, equipment, and workmanship for a minimum of one (1) year.
 - 1 Warranty shall provide repair/replacement of all defective or improperly installed materials at no additional cost to the Owner (including all costs to repair or replace the item(s)).
 - 2 Contractor shall provide a competent service technician and new materials to repair/replace defective items no later than 24 hours after notification.
- D The work performed under this specification shall be of good quality and performed in a workmanlike manner. In this context 'good quality' means the work shall meet industry technical standards and quality of appearance. The Owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.
- E The Contractor shall provide all necessary materials and labor for a complete, functional Telecommunications cabling infrastructure in accordance with all applicable standards and the Construction Documents.

1.5 SUBMITTALS

- A Submit under provisions of Section 013000 or 013300.
- B Submittals shall include the following:
 - 1 Table of contents
 - 2 A complete set of detailed manufacturer's specifications describing and illustrating all standard and special components and materials
 - 3 Part numbers
 - 4 Evidence of compliance with the applicable standards listed under Article 1.3 of this section
 - 5 Maintenance instructions and intervals
 - 6 A complete set of drawings for any special items
 - 7 A single line block diagram showing exactly the manner in which the contractor proposes to layout the system.
 - 8 Wiring diagrams
 - 9 Illustrations and scale drawing of the racks, equipment layouts etc.
 - 10 Drawings shall include designations, dimensions, operating controls, instruments, riser diagrams, routing diagrams etc.
- C Electronic submittals shall be searchable
- D The submittal shall be substantially complete for all items and equipment furnished under this section.
- E Individual drawings and data sheets submitted at random intervals will not be accepted for review.
- F Substitutions: Items of same function and performance shall be submitted in conformance with Division 1.

1.6 OPERATION AND MAINTENANCE MANUALS

- A Submit operation and maintenance manuals in accordance with Section 260000.
- B The manuals shall, at minimum, include the following:
 - 1 Table of contents
 - 2 Manufacturer (including contact information)
 - 3 Model number
 - 4 Programming manual (where applicable)
 - 5 Wiring diagrams

- 6 Trouble-shooting guidelines (where applicable)
 - 7 Voltage ratings
 - 8 Current ratings
 - 9 Calibrated range (where applicable)
 - 10 List of capabilities
 - 11 Environmental ratings
 - 12 NEMA enclosure type
 - 13 Maintenance instructions and intervals
 - 14 Calibration procedures and intervals
 - 15 Installation instructions
 - 16 Repair instructions (where applicable)
 - 17 As-built drawings
- C Provide manuals in one of the following formats
- 1 Three hardcopies
 - 2 PDF

1.7 DEFINITIONS

- A. Intermediate distribution frame (IDF): An intermediate distribution of horizontal cabling to other cabling (e.g. horizontal, backbone, or equipment).
- B. Main Distribution Frame (MDF): A main distribution for, 1st level backbone cables, entrance cables, and equipment cables. The Main Distribution-frame is often co-located in the building Entrance Facility (EF) and/or Equipment Room (ER) and consisting of riser cable terminals, utility service cables terminals, PBS terminals, and other equipment.

PART 2 – PRODUCTS

2.1 GENERAL

- A. All IDF, MDF, et cetera shall be enclosed unless open racks are called out on the plans.
- B. Top of wall mounted IDFs shall be 18” below ceiling.
- C. Provide all necessary mounting hardware.
- D. All material shall be UL listed for its application.

2.2 ENCLOSURES AND RACKS

- A. Manufacturers
 - 1. APC
 - 2. Black Box
 - 3. Chatsworth Products, Inc.
 - 4. Cooper B-Line
 - 5. Hoffman Enclosures
 - 6. Hubbell Premise Wiring
 - 7. Southwest Data Products
- B. Main Distribution Frames
 - 1. Four posts: Front and rear pairs of 3” deep C-shaped equipment mounting channels, 19” wide
 - 2. Minimum of 42 rack units
 - 3. 2000 pound static load capacity

4. Provisions for anchoring to floor
 5. Zone 4 Seismic rated
 6. Provide and install a minimum of 6 shelves with the following requirements
 - a. 4 points of attachment
 - b. 200 pound capacity
 - c. Vented
 7. Mount a backboard on wall behind cabinet or rack
 - a. 48" wide by 96" high by 3/4" deep plywood
 - b. Mounting: 3/8"x2" long wood or self-tapping screw every 12" along wall stud
 - c. Paint with 3 coats of fire resistant paint.
 8. Fiber optic cable storage ring: Black Box FOSR24
 9. MDFs shall be floor mounted unless otherwise noted.
- C. Intermediate Distribution Frames
1. Four posts
 2. Minimum of 24 rack units
 3. 300 pound static load capacity
 4. Provisions for wall mounting
 5. Provide and install a minimum of 3 shelves with the following requirements
 - a. 4 points of attachment
 - b. 60 pound capacity
 - c. Vented
 6. 18" DIN rail
 7. Mount a backboard inside rear of cabinet (enclosed IDF) or on wall behind rack (open IDF)
 - a. 3/4" plywood
 - b. Mounting: 3/8"x2" long wood or self-tapping screw every 12" along wall stud
 - c. Paint with 3 coats of fire resistant paint.
 8. Fiber optic cable storage ring: Black Box FOSR12
 9. IDFs shall be wall mounted unless otherwise noted.
- D. Cabinets
1. General
 - a. Material: Steel
 - b. 18" DIN rail
 - c. Wall mounted cabinets shall be composed of three sections:
 - 1) Rear panel mounted to wall
 - 2) Main section shall be hinged on rear panel and include lock to secure in closed position to rear panel.
 - 3) Front door shall be hinged on main section and lockable in the closed position.
 - d. Hinges shall be reversible to allow swing open from the right or left.
 - e. The front door shall have rounded edges and corners.
 - f. Floor mounted cabinets shall have locking front and rear doors.

2. Enclosed rack/cabinet in cooled room
 - a. Top mounted ventilation fan(s)
 - 1) Minimum flow rate of 450 CFM for MDF cabinet
 - 2) Minimum flow rate of 225 CFM for IDF cabinet
 - b. MDF cabinets shall include 250 CFM enclosure blower.
 - c. Ventilation openings in sides or front
 - d. MDF cabinets shall have locking, mesh front and rear doors.
 - e. IDF cabinets shall have a locking front door with smoked poly-methyl-methacrylate window.
 - f. Install temperature switch in cabinet to turn the fan on at 100°F and off at 90°F.
3. Coating
 - a. The completed rack or cabinet shall be degreased and cleaned.
 - b. After the cleaning process is finished, the rack or cabinet shall be phosphatized.
 - c. After the phosphatizing, the rack or cabinet shall receive an electrostatic deposition of polyester powder coating followed by baking to produce a hard durable finish.
 - 1) The minimum thickness of the paint film shall be 2.0 mils.
 - 2) Paint film shall be uniform in color and free from blisters, sags, flaking and peeling
 - d. Finish shall conform to UL 50 and UL 50E.
 - e. Color shall be black for interior locations and ANSI 61 gray for exterior locations.
 - f. Coat underside surfaces of equipment outdoors or in damp locations with a corrosion resistant coating.
- E. Each rack unit space shall be identified on the racks/posts.
- F. The contractor shall calculate space requirements prior to ordering equipment. If the specified enclosure or rack is not large enough, the contractor shall order the size required for the equipment to be installed.

2.3 COPPER PATCH PANELS

- A. 48 Port, Category 6a patch panel: Panduit #CPP48WBLY
- B. Data ports
 1. RJ45 design
 2. Terminate 26AWG to 22 AWG, stranded or solid, Cat-6A cables without punch-down tool
 3. Suppress alien cross-talk
 4. Maintain 10GB/S performance in 48 port, 1RU patch panels
 5. T568B wiring scheme
 6. Meet or exceed Cat-6A requirements of TIA-568-C.2 and IEEE 802.3an.
 7. Compatible with IEEE 802.3at POE+
 8. Snap in, snap out modular design
 9. Conductor retention and strain relief
 10. Gold plated contacts
 11. Manufacturer and models
 - a. Black: Panduit #CJ6X88TGBL
 - b. Blue: Panduit #CJ6X88TGBU
 - c. Green: Panduit #CJ6X88TGGR
 - d. Purple: Panduit #CJ6X88TGVL

- e. Red: Panduit #CJ6X88TGRD
- f. White: Panduit #CJ6X88TGIW
- g. Yellow: Panduit #CJ6X88TGYL
- 12. Ports in patch panels shall be grouped by use (data, VOIP, clock/public address, etc.)
- C. Patch cords
 - 1. RJ45 design
 - 2. Four twisted, unshielded, 23 AWG, solid pairs (23 AWG UTP)
 - 3. Suppress alien cross-talk
 - 4. Maintain 10GB/S performance
 - 5. T568B wiring scheme
 - 6. Meet or exceed Cat-6A requirements of TIA-568-C.2 and IEEE 802.3an.
 - 7. SRL, Attenuation and NEXT results shall use Sweep Frequency test per TIA-568-C.
 - 8. Compatible with IEEE 802.3at POE+
 - 9. Snagless latch on plugs
 - 10. Length shall be 12 inches
 - 11. Manufacturer and models
 - a. Black: Panduit #UTP6A1BL
 - b. Blue: Panduit #UTP6A1BU
 - c. Green: Panduit #UTP6A1GR
 - d. Purple: Panduit #UTP6A1VL
 - e. Red: Panduit #UTP6A1RD
 - f. White: Panduit #UTP6A1IW
 - g. Yellow: Panduit #UTP6A1YL
- D. Colors for RJ45 ports and patch cables shall be:
 - 1. Clocks: Green
 - 2. Data: Blue
 - 3. Energy management system: Purple
 - 4. Power distribution units: Black
 - 5. Servers: White
 - 6. Speakers: Green
 - 7. Surveillance: Red
 - 8. Uninterruptable power supplies: Black
 - 9. Wireless access points: Yellow
- E. Quantity: provide and install sufficient patch panels and patch cords to accommodate all devices with:
 - 1. 48 spare ports for MDFs
 - 2. 24 spare ports for IDFs
- F. Port identification: Panduit #C061X030FJJ

2.4 FIBER OPTIC PATCH PANELS

- A. Patch panel: Panduit #CFAPPBL1
- B. Fiber adapter panels (FAP)
 - 1. Multi-mode
 - a. OM4
 - b. 12 Duplex LC adapters per FAP
 - c. Zirconia ceramic, split sleeve ferrules
 - d. Color: Blue
 - e. Manufacturer: Panduit

2. Single-mode
 - a. OS2
 - b. 12 Duplex LC adapters per FAP
 - c. Zirconia ceramic, split sleeve ferrules
 - d. Color: Green
 - e. Manufacturer: Panduit
- C. Install blank adapter panel in each unused space in the patch panel: Panduit #FAPB
- D. Fiber optic patch cords
 1. Cords shall have duplex LC connectors on one end and SFP connectors on other end.
 2. Length shall be 8 inches for patch panel adjacent to switch. Add 1.75 inches to length for each rack unit separating patch panel from switch.
 3. Multi-mode patch cords shall be OM4. Single-mode patch cords shall be OS2.
 4. Cord and connector colors shall match adapter colors.
- E. Quantity: provide and install sufficient devices to accommodate all backbone cable strands with:
 1. 36 spare terminals for MDFs
 2. 12 spare terminals for IDF
- F. Port identification: Panduit #C061X030FJJ

2.5 TELCO SPLICE BLOCKS

- A. Where called out on plans provide and install a 50 pair, Type 66 Telco Splice Block; Black Box JP620 or equivalent.
- B. Quantity: provide and install sufficient splice blocks to accommodate 150% of phone lines terminating at MDF.
- C. All terminals shall be screw type.

2.6 POWER SUPPLIES

- A. IDF Uninterruptable Power Supply
 1. UPS shall be APC rack mountable Smart-UPS or Symmetra series.
 2. Refer to plans for size of UPS. If size is not shown on plans, size of UPS shall be 900VA per 48 port LAN switch.
 3. Provide and install APC AP9631 Network Management Card with Environmental Monitoring and APC AP9335TH temperature and humidity sensor.
 4. Provide and install Cat-6A patch cord from UPS to LAN switch.
- B. All UPS feeding data equipment shall have battery packs allowing for 30 minutes of runtime at full load during power outage.
- C. Power Distribution Units
 1. PDUs shall be rack mounted, switched outlet type with sequenced start-up.
 2. PDU(s) shall have a minimum of 8 5-15R and/or 5-20R per 2kVA of UPS capacity. Coordinate receptacle types with equipment being fed by PDU(s).
 3. Quantity of PDUs shall allow usage of full capacity of UPS.
 4. PDUs shall be capable of cycling power to each receptacle via network.
 5. Coordinate input type(s) of PDU(s) with output type(s) of UPS.
 6. Provide and install Cat-6A patch cord from each PDU to LAN switch.

- D. All UPSs and PDUs shall include the following features.
 - 1. Minimum of one RJ-45 Ethernet port
 - 2. SNMPv3, SSL, SSH
 - 3. Password protection
 - 4. User defined alarms with email alerting
 - 5. Load display
- E. Provide and install APC InfraStruxure Manager software and license for each UPS and PDU.

2.7 GROUNDING AND BONDING

- A Grounding Busbar
 - 1 Grounding Busbars shall be 4" high by 12" wide by 0.25" thick solid copper bar.
 - 2 The busbar shall be 4" high and 12" long and shall have 18 attachment points (two rows of 9 each) for two-hole grounding lugs.
 - 3 The hole pattern for attaching grounding lugs shall meet the requirements of TIA-607-B and shall accept 30 lugs with 5/8" hole centers and 6 lugs with 1" hole centers.
 - 4 The busbar shall include wall-mount stand-off brackets, assembly screws and insulators.
 - 5 The busbar shall be UL Listed as grounding and bonding equipment.
 - 6 Grounding Busbar shall be Chatsworth Products, Inc. 40153-012, or approved equal.
- B Vertical Rack Busbar
 - 1 Vertical, rack-mounted busbar shall be constructed of 1/4" thick by 5/8" wide, hard-drawn copper bar.
 - 2 Busbar shall be designed to mount into the channel of the rack without interfering with mounting of equipment on the rack.
 - 3 Bar shall have eight 6-32 tapped ground mounting holes on 1" intervals and four 0.281" holes for the attachment of two-hole grounding lugs.
 - 4 Busbars shall run entire height of rack.
 - 5 Busbars shall be Chatsworth Products, Inc. 40161-036 and/or 40161-072
- C Antioxidant Joint Compound
 - 1 Aluminum to copper: Chatsworth Products, Inc. 40166-xxx
 - 2 Copper to copper: Chatsworth Products, Inc. 40168-xxx

2.8 SURGE SUPPRESSION

- A. Provide and install a 10 GB/S data-line surge suppressor for each data and VOIP cable entering a building: Phoenix Contact #DT-LAN-CAT.6+
- B. Provide and install a telephone line surge suppressor for each analog telephone line entering a building: Black Box #SP365A-R2 or equivalent

PART 3 – EXECUTION

3.1 INSTALLATION

- A Cabinets, racks, and enclosures
 - 1 Mount all cabinets and racks to walls or floors according to the Typical Electrical Details.

- 2 Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
- B Cable trays
 - 1 Cable trays must be securely attached to walls, backboards, and racks/cabinets to comply with all Zone 4 seismic requirements.
 - 2 Cable trays shall be installed so that there is a minimum of 8" of unobstructed clearance above rack.
 - 3 Cable trays shall be installed so that there is a minimum of 12" of clearance from all florescent lighting, electrical conduits/circuits, and fire alarm conduits/devices.
 - 4 Cable trays shall be NEMA class designation 12B.
- C Rack mounted equipment
 - 1 Securely fasten all rack mounted equipment to each rack rail with a minimum of two screws per rail and according to manufacturers' recommendations.
 - 2 Patch panels shall be mounted to front pair of rack rails.
 - 3 PDUs shall be mounted to rear pair of rack rails.
 - 4 All other equipment shall be mounted to both pairs of rack rails.
 - 5 Alternate patch panels and switches so that each port in the patch panel is adjacent to the corresponding port in the switch.
- D Cable management
 - 1 Install vertical cable management raceways on each post of freestanding racks.
 - 2 Install fiber optic storage ring on backboard behind each IDF/MDF or in rear of IDF cabinet. Loop each fiber optic cable round ring 3 times. Install ID tag on loop of each cable.
- E Grounding and Bonding
 - 1 Each MDF and IDF shall be equipped with a grounding busbar.
 - 2 Each grounding busbar shall be connected to the building electrical grounding facility per plans.
 - 3 All metallic equipment, including but not limited to, each rack, metallic backboard, cable sheath, metallic strength member, splice case, cable tray shall be grounded to its respective grounding busbar using a minimum #6 AWG stranded copper bonding conductor with a green insulation and compression connectors.
 - 4 Wall mounted grounding busbars
 - a Attach busbars to the wall with appropriate hardware according to the manufacturer's installation instructions and Typical Electrical Details.
 - b Conductor connections to the grounding busbar shall be made with two-hole bolt-on compression lugs sized to fit the busbar and the conductors.
 - c Each lug shall be attached with stainless steel hardware after preparing the bond according to manufacturer recommendations and treating the bonding surface on the busbar with antioxidant to help prevent corrosion at the bond.
 - d The wall-mounted busbar shall be bonded to ground as part of the overall Telecommunications Bonding and Grounding System.

- 5 Rack-Mount Busbars and Ground Bars
 - a Each rack and cabinet shall be equipped with a vertical grounding busbar.
 - b Attach rack-mount busbars and ground bars to racks according to the manufacturer's installation instructions.
 - c Bond the rack-mount grounding busbar to the rack, cabinet, and room's grounding busbar with appropriately sized hardware and conductor.
- 6 Equipment Ground Jumper Kit
 - a Bond equipment to a vertical rack-mount grounding busbar using ground jumper according to the manufacturer's recommendations.
 - b Clean the surface and use antioxidant between the compression lugs on the jumper and the rack-mount grounding busbar to help prevent corrosion at the bond.
- F Program UPSs, PDUs, and software to set alarms for current overload, temperature out of limits, and humidity out of limits and send email notification of alarm conditions.

3.2 LABELING

- A. The contractor shall follow the Owner's labeling scheme.
- B. Each IDF and MDF shall be labeled.
- C. Each IDF, MDF, patch panel, port, switch, and cable shall have a unique identification.
- D. Label each port on the patch panel and faceplate with its identification.
- E. Label each cable at its beginning and end points no further than 6" behind termination on a section of cable that is easily accessible. Cable labels shall include the ids of both terminations and cable id.
- F. Label the plug end of each power cord with id of equipment it feeds.
- G. Each faceplate shall be machine labeled. The labeling shall be placed on the faceplate so that the individual jack can be clearly identified by its associated label.
- H. All labels shall be machine printed. Handwritten labels are not acceptable.
- I. All labeling information shall be recorded on the as-built drawings and all test documents.

3.3 SYSTEM CLOSEOUT AND AS-BUILT DOCUMENTATION

- A Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Owner's Representative/Engineer for approval. One (1) to be a hardcopy and two (2) to be electronic copies. Documentation shall include the items detailed in the sub-sections below.
- B Documentation shall be submitted within ten (10) working days of the completion of each testing phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 calendar days of the completion of each testing phase. At the request of the Owner's Representative/Engineer, the telecommunications contractor shall provide copies of the original test results.
- C The Owner's Representative/Engineer will request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing

- can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.
- D Test Results documentation shall be provided in two media, as listed above, one (1) hardcopy and one (1) on disk within three weeks after the completion of the project. The documentation shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, a bi-annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
 - E Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package.
 - F When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.
 - G The As-Built drawings are to include cable routes, outlet locations and the approved labeling identifiers. Their sequential number as defined elsewhere in this document shall identify outlet locations. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD 2008) formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.
 - H Contractor will provide one laminated 11"x17" drawing at each IDF and MDF that includes the building layout for that IDF or MDF, along with the outlet locations and all of the approved labeling.

END OF SECTION

SECTION 271500 – COMMUNICATIONS HORIZONTAL CABLING

PART 1 – GENERAL

1.1 SECTION INCLUDES

This section includes material and workmanship requirements for data, telephone (analog and VOIP), IP clocks, and IP speakers horizontal cabling.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A Division 1
 - 1 Section 013000: Administrative Requirements
 - 2 Section 013300: Submittal Procedures
 - 3 Section 014000: Quality Requirements
 - 4 Section 016000: Product Requirements
 - 5 Section 017000: Execution and Closeout Requirements
 - 6 All other included sections under Division 1
- B All included sections under Division 26
- C All included sections under Division 27
- D Plans
- E Manufacturers' manuals, product bulletins, etc.

1.3 REFERENCE STANDARDS AND CODES

- A. Governing Codes and Conflicts: If the requirements of the Construction Documents exceed those of the governing codes and regulations, then the requirements of the Construction Documents shall prevail. Where a conflict exists, the governing codes and ordinances shall supersede all other requirements.
- B. ANSI: American National Standards Institute (ANSI)
- C. CEC: California Electrical Code
- D. Institute of Electrical and Electronic Engineers (IEEE)
 - 1. IEEE 802.3: IEEE Standard for Ethernet
 - 2. IEEE 802.3ad: Link Aggregation
 - 3. IEEE 802.3af: Power over Ethernet
 - 4. IEEE 802.3at: Enhanced Power over Ethernet
- E. Insulated Cable Engineers Association (ICEA)
 - 1. ICEA S-84-608: Telecommunications Cables, Filled Polyolefin Insulated, Copper Conductor
 - 2. ICEA S-102-700: ICEA Standard for Category 6 Individually Unshielded, Twisted Pair Indoor Cables (With or Without an Overall Shield) for Use in Communications Wiring Systems Technical Requirements
- F. Telecommunications Industries Association (TIA)
 - 1. TIA-568-C: Commercial Building Telecommunications Standard
 - 2. TIA-568-C.0: Generic Telecommunications Cabling for Customer Premises
 - 3. TIA-568-C.1: Commercial Building Telecommunications Cabling Standard
 - 4. TIA-568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 - 5. TIA-569-C: Commercial Building Standard for Telecommunications Pathways and Spaces

6. TIA-606-B: Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 7. TIA-607-B: Commercial Building Grounding and Bonding Requirements for Telecommunications
 8. TIA-758-B: Customer Owned Outside Plant Telecommunications Infrastructure Standard
 9. TIA-1152: Requirements for Field Test Instruments and Measurements for Balanced Twisted Pair Cabling
 10. TIA-1183: Measurement Methods and Test Fixtures for Balun-less Measurement of Balanced Components and Systems
 11. TIA-TSB-36: Technical Systems Bulletin Additional Cable Specifications for Unshielded Twisted-Pair Cables
 12. TIA-TSB-67: TIA Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair Connecting Hardware
 13. TIA-TSB-184: Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling
 14. TIA-TSB-1197: Mode Conversion Parameters for Balanced Twisted Pair Cabling
- G. Underwriters Laboratories, Inc.
1. UL 444: Communications Cables
 2. UL 1666: Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
 3. UL 1690: Standard for Data-Processing Cable
 4. UL 1863: Communications Circuit Accessories
 5. UL 1977: Component Connectors for Use in Data, Signal, Control, and Power Applications
 6. UL 2024: Standard for Signaling, Optical Fiber and Communications Raceways and Cable Routing Assemblies
 7. UL 2269: Optical Fiber/Communications/Signaling/Coaxial Cable Outlet Boxes
 8. UL 62368-1: Audio/video, information and communication technology equipment - Part 1: Safety requirements

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- notice for non- emergency issues, and a minimum of 4 hours for emergency issues at no additional cost to the Owner.
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 - e No corrosion or other degradation of material
 - f In factory condition
 - g Unmodified
 - 4 If used material or equipment has been installed on this project the Contractor shall replace said materials and/or equipment with new products at no additional cost to the Owner.
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 - 7 Deliver, store and protect products under provisions of Section 016200.
 - 8 Ship equipment in its original packages, to prevent damaging or entrance of foreign matter. Perform handling and shipping in accordance with manufacturer's recommendations. Provide protective covering during construction.
 - 9 Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by the engineer.
 - 10 Tag items with a weatherproof tag identifying equipment by name and purchase order number. Include packing and shipping lists.
- C** Contractor shall warranty all materials, equipment, and workmanship for a minimum of one (1) year.
- 1 Warranty shall provide repair/replacement of all defective or improperly installed materials at no additional cost to the Owner (including all costs to repair or replace the item(s)).
 - 2 Contractor shall provide a competent service technician and new materials to repair/replace defective items no later than 24 hours after notification.

1.5 SUBMITTALS

- A Submit under provisions of Section 013000 or 013300.
- B Submittals shall include the following:

- 1 Table of contents
 - 2 A complete set of detailed manufacturer's specifications describing and illustrating all standard and special components and materials
 - 3 Part numbers
 - 4 Evidence of compliance with the applicable standards listed under Article 1.3 of this section
 - 5 Maintenance instructions and intervals
 - 6 A complete set of drawings for any special items
 - 7 A single line block diagram showing exactly the manner in which the contractor proposes to layout the system.
 - 8 Wiring diagrams
 - 9 Drawings shall include designations, dimensions, operating controls, instruments, riser diagrams, routing diagrams etc.
- C Electronic submittals shall be searchable
- D The submittal shall be substantially complete for all items and equipment furnished under this section.
- E Individual drawings and data sheets submitted at random intervals will not be accepted for review.
- F Substitutions: Items of same function and performance shall be submitted in conformance with Division 1.

1.6 OPERATION AND MAINTENANCE MANUALS

- A Submit operation and maintenance manuals in accordance with Section 260000.
- B The manuals shall, at minimum, include the following:
- 1 Manufacturer (including contact information)
 - 2 Model number
 - 3 Programming manual (where applicable)
 - 4 Wiring diagrams
 - 5 Trouble-shooting guidelines (where applicable)
 - 6 Voltage ratings
 - 7 Current ratings
 - 8 Calibrated range (where applicable)
 - 9 List of capabilities
 - 10 Environmental ratings
 - 11 NEMA enclosure type
 - 12 Maintenance requirements
 - 13 Installation instructions
 - 14 Repair instructions (where applicable)
- C Provide manuals in one of the following formats
- 1 Three hardcopies
 - 2 PDF

PART 2 – PRODUCTS

2.1 GENERAL

- A. All material shall be UL listed for its application.
- B. Cables shall be rated for its intended use, i.e. plenum, riser, wet location, etc.
- C. Cables, conductors, and all other components shall meet the requirements of standards listed in Section 1.3.

2.2 DATA AND VOIP HORIZONTAL CABLING

- A. Contractor shall provide, install, and test a Cat-6 cable link from each Data/VOIP Outlet directly to the IDF utilizing the hardware listed below (or approved equivalent) in full compliance with all applicable standards, local and national codes, manufacturers' recommendations, and otherwise noted within these specifications.
- B. Specifications:
 - 1. Four twisted, unshielded, 23 AWG, solid copper pairs (23 AWG UTP)
 - 2. Suppress cross-talk
 - 3. Maintain 10GB/S performance
 - 4. Meet or exceed Cat-6 requirements of TIA-568-C.2 and IEEE 802.3an.
 - 5. SRL, Attenuation and NEXT results shall use Sweep Frequency test per TIA-568-C.
 - 6. Have UL verification to Cat-6 specifications.
 - 7. Compatible with IEEE 802.3at POE+
 - 8. Color for cables shall be blue.
 - 9. Berk-Tek LANmark-2000 or approved equal
- C. Cables shall be rated for its intended use, i.e. plenum, riser, wet location, etc.
- D. Cables, conductors, and all other components shall meet the requirements of standards listed in Section 1.3.
- E. Provide all termination accessories, dressing accessories, enclosures, and testing for a complete fiber optic distribution system. Refer to Specification Section 271100.
- F. Identification
 - 1. Interior: Panduit S100X225YAJ self-laminating, polyester label
 - 2. Exterior: Panduit MT350W17-Q stainless steel tag with rounded edges & corners
- G. Contractor shall determine cable "link" quantities as shown on the Construction Documents.

2.4 OUTLET HARDWARE

- A. Data and VOIP Ports:
 - 1. Category 6, RJ45 port: Panduit CJ688TGBUY
 - 2. Terminate 26AWG to 22 AWG, stranded or solid, Cat-6 cables without punch-down tool
 - 3. Suppress cross-talk
 - 4. Maintain 1GB/S performance in 48 port, 1RU patch panels
 - 5. T568B wiring scheme
 - 6. Meet or exceed Cat-6 requirements of TIA-568-C.2.
 - 7. Compatible with IEEE 802.3at POE+

- 8 Snap in, snap out modular design
- 9 Conductor retention and strain relief
- 10 Gold plated contacts
- B Wallplates:
 - 1 Commercial , educational, industrial, and institutional
 - a Material: Satin finish stainless steel
 - b For data or telephone – one module space: Black Box WP370 or equivalent
 - c For data and telephone – two module spaces: Black Box WP371, Panduit CFPL2SY, or equivalent
 - d For data and telephone – two module spaces: Black Box WP373, Panduit CFPL4SY, or equivalent
 - 2 Residential:
 - a Material: Nylon
 - b Color: Wallplate color shall closely match wall color.
 - c For data or telephone – one module space: Panduit NK1FNWH or equivalent
 - d For data and telephone – two module spaces: Panduit NK2FNWH or equivalent
 - e Wallplate Specifications: The wallplate housing shall be a one-piece, single-gang flush mount style that fits standard NEMA openings, on four-square boxes with reducer. It should provide 1-port field-configurable with a variety of simplex snap-in ports/connectors. It must be made of high-impact, self-extinguishing plastic rated UL 94V-0, and be UL Listed, CSA certified, and compliant with FCC Part 68 and TIA-568-C specifications. Wallplate screws must match wallplate color.
 - 3 Provide an install a blank module for each unused opening in the wallplates, Panduit CMBIG-X or equivalent.
 - 4 Labels: Panduit C125X030YPT self-adhesive, polyester label
- C Back box: 4 inch square box with one gang plaster

2.5 MISCELLANEOUS MATERIALS

- A Conduits: Refer to Section 260500.
- B Supports: Refer to Section 260529.
- C J-Hooks shall be steel with closure and two bolt holes. Finished part shall be hot dipped galvanized.

2.6 IDENTIFICATION

- A Interior: Panduit #S100X225YAJ self-laminating, polyester label
- B Exterior: Panduit #MT350W17-Q stainless steel tag with rounded edges & corners

PART 3 – EXECUTION

3.1 INSTALLATION

A Cables

- 1 Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
- 2 Contractor shall use Velcro strip to bundle cables together. Tie Wraps will not be allowed for supporting, bundling, and/or dressing of any cables.
- 3 Contractor shall provide a three foot service loop for all cables. The service loop will be coiled and secured using Velcro in the accessible ceiling at the conduit stub to the work area outlet box.
- 4 A 1/8" diameter, nylon pull cord shall be co-installed with all cable installed in any conduit.
- 5 Cable raceways shall not be filled greater than the TIA-569-C maximum fill for the particular raceway type or 40%.
- 6 Cables shall be installed in continuous lengths from origin to destination. Splices are not permitted.
- 7 Do not exceed the manufacturer's minimum bend radius and maximum pulling tension for cables.
- 8 Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
- 9 Cables shall be dressed and terminated in accordance with the recommendations made in the TIA-568-C standards, manufacturer's recommendations, and best industry practices.
- 10 The cable jacket shall be maintained to within 1/2 inch of the termination point.
- 11 Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable every 3 feet.
- 12 Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.
- 13 All cables shall be neatly bundled and dressed continuously from the entrance point of the data room or cabinet to their respective panels. Each panel shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame. Cables in all other rooms shall be concealed.
- 14 Inside Buildings: Cable and conductors shall be routed in conduit, or surface mounted raceway, run overhead and parallel to the structure.
 - a Conduit shall be rigid steel, IMC, or EMT as described elsewhere in these specifications.
 - b Plastic conduit shall not be used above grade.
 - c Cable may be used behind accessible T-bar ceilings without conduit. Mount cable at the roof joist (or bottom of floor above) on 1" wide 'J-hooks' or 'bridle-rings' at every 5'-0" or less. Support each cable within 1'-0" of its termination point. Run cable parallel and perpendicular to the building structure and provide mechanical support for vertical runs by using Unistrut channel securely fastened in place.

- d Cable and conductors shall not be attached to the support wire of the T-bar ceiling or laid across the ceiling boards.
 - 15 Between buildings: Cable and conductors shall be routed in conduit run underground.
 - a Conduit shall be rigid steel, IMC, or plastic as described elsewhere in these specifications.
 - b The use of EMT is not acceptable.
 - 16 On The Roof: Conduit shown on the drawings as being on the roof of the building or covered walkway shall be installed on 4" by 4" pressure treated wood blocking (sleepers) attached to the structure every 8'-0" or less.
 - a Conduit shall be rigid steel or IMC as described elsewhere in these specifications.
 - b The use of EMT or plastic conduit is not acceptable.
 - 17 Make all underground runs continuous without splices or taps. Use underground boxes for *pulling purposes only*.
 - 18 Only use pulling grip approved by the cable manufacturer.
 - 19 Clean conduit with mandrel prior to pulling.
 - 20 Make all connections and splices in a clean environment.
 - 21 Follow cable manufacturer's and device manufacturer's instructions for connections to devices.
 - 22 Maximum combined cable length (patch cords and installed cable) from switch to end user equipment shall be 328 feet.
 - 23 Stranded conductors shall be "tinned" with solder before terminations are made.
 - 24 Make all terminations in cabinets and at terminal backboards on terminal blocks and/or Patch Panels as specified above.
- B Outlets Installation
- 1 No more than 12" of cable shall be stored in an outlet box, modular furniture raceway, or insulated walls.
 - 2 Data jacks, unless otherwise noted in drawings, shall be located in the top position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the left-most position(s).
 - 3 Voice jacks, unless otherwise noted in drawings, shall occupy the next position(s) below the data on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the position right of the data jack.
 - 4 All faceplates installed shall be level.

3.2 LABELING

- A. The contractor shall follow the Owner's labeling scheme.
- B. Label each cable at its beginning and end points no further than 6" behind termination on a section of cable that is easily accessible. Cable labels shall include the ids of both terminations and cable id.
- C. All labels shall be machine printed or embossed. Handwritten labels are not acceptable.
- D. All labeling information shall be recorded on the as-built drawings and all test documents.
- E. Label all cable beginning and terminating points.
- F. Labels for site cables and cables in multiple buildings shall feature the following.
 - 1. Identify origin (MDF or IDF and building), termination (IDF or port identifier), and next pull box.

2. Cables in pull boxes shall have a label at entry into pull box and exit from pull box. Labels shall be stainless steel tags with embossed characters.

3.3 TESTING

A. General

1. All cables (including each fiber) and termination hardware shall be tested.
2. Testing must comply with TIA standards for testing (refer to Section 1.3), plans, specifications, and manufacturer recommendations.
3. Contractor shall notify the Owner or Owner's Representative 72 hours before commencement of testing.
4. Upon receipt of the test documentation, the Customer reserves the right to have the contractor perform a 20% witnessed "spot testing" of the cabling system to validate test results provided in the test document, at no additional cost. If a significant amount of cables are marginal and/or fail during the "spot test" Contractor will retest the entire cable plant at no additional cost.

B. Equipment

1. All equipment must be properly calibrated and traceable to NIST.
2. Equipment shall have been recalibrated within the previous 6 month prior to testing.

C. Data Copper Cables:

1. Each pair in each cable shall be tested in accordance with TIA-568-C series and TIA-TSB-67 for:
 - a. Opens
 - b. Shorts
 - c. Grounds
 - d. Continuity
 - e. Polarity
 - f. DC resistance
 - g. DC resistance unbalance
 - h. Impulse noise
 - i. Signal attenuation
 - j. NEXT
 - k. PS-NEXT
 - l. ELFEXT
 - m. PS-ELFEXT
 - n. Return loss
 - o. Propagation delay
 - p. Delay skew
2. Each installed cable link shall be tested for installed length using a TDR type device. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number.
3. Conductors and connectors shall be tested as a complete system.
4. Testing of all horizontal cable, outlet ports, patch cords, and riser cable pairs shall include end-to-end tests using a Wavetech Lantek 100 or Fluke Network's DXT CableAnalyzer Series scanner.
5. Test cables to check that they meet all IEEE and TIA Cat-6 and 1GB/S performance specifications (refer to Section 1.3).

6. All installed cables must meet or exceed the defined standards for performance. The Contractor shall take all steps necessary to repair or replace any optic not meeting the standard.
7. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA standards.
8. The test equipment shall provide a printed document for each test that is also available in a downloadable file using an application from the test equipment manufacturer. The printed test results shall include a print out of all tests performed, and the individual test results for each cable.

3.4 SYSTEM CLOSEOUT AND AS-BUILT DOCUMENTATION

- A Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Owner's Representative/Engineer for approval. One (1) to be a hardcopy and two (2) to be electronic copies. Documentation shall include the items detailed in the sub-sections below.
- B Documentation shall be submitted within ten (10) working days of the completion of each testing phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 calendar days of the completion of each testing phase. At the request of the Owner's Representative/Engineer, the telecommunications contractor shall provide copies of the original test results.
- C The Owner's Representative/Engineer will request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.
- D Test Results documentation shall be provided in two media, as listed above, one (1) hardcopy and one (1) on disk within three weeks after the completion of the project. The documentation shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, a bi-annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
- E Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package.
- F When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.
- G The As-Built drawings are to include cable routes, outlet locations and the approved labeling identifiers. Their sequential number as defined elsewhere in this document shall identify outlet locations. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD 2008)

formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.

- H Contractor will provide one laminated 11"x17" drawing at each IDF and MDF that includes the building layout for that IDF or MDF, along with the outlet locations and all of the approved labeling.

END OF SECTION

SECTION 283100 – FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete system.
- B. The intent of drawings and specifications is to result in a complete and functional Fire Alarm System as described herein. The Contractor shall provide all control panels, initiation devices, notification appliances, controls, supervisory devices, and any other device necessary to accomplish this intent, whether or not specifically shown or specified.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 1
 - 1. Section 013000: Administrative Requirements
 - 2. Section 013300: Submittal Procedures
 - 3. Section 014000: Quality Requirements
 - 4. Section 016000: Product Requirements
 - 5. Section 017000: Execution and Closeout Requirements
 - 6. All other included sections under Division 1
- B. All included sections under Division 26
- C. All included sections under Division 27
- D. All included sections under Division 28
- E. Plans
- F. Manufacturers' manuals, product bulletins, etc.

1.3 REFERENCE STANDARDS AND CODES

- A. Published specifications standards, tests, or recommended methods of trade, industry or government organizations apply to work in this section as cited here and in Section 260000.
- B. National Fire Protection Association (NFPA) :
 - 1. NFPA 70 National Electrical Code (NEC) w/ State Amendments (CEC)
 - 2. NFPA 72 National Fire Alarm and Signaling Code
 - 3. NFPA 101 Life Safety Code
- C. Underwriters Laboratories Inc. (UL):
 - 1. UL 38 Manually Actuated Signaling Boxes.
 - 2. UL 50: Enclosures for Electrical Equipment, Non-environmental Considerations
 - 3. UL 50E: Enclosures for Electrical Equipment, Environmental Considerations
 - 4. UL 268 Smoke Detectors for Fire Protective Signaling Systems
 - 5. UL 268A Smoke Detectors for Duct Applications.
 - 6. U; 346 Water flow Indicators for Fire Protective Signaling Systems.

7. UL 464 Audible Signaling Appliances.
 8. UL 521 Heat Detectors for Fire Protective Signaling Systems
 9. UL 753: Alarm Accessories for Automatic Water Supply Control Valves for Fire Protection Service
 10. UL 864 Control Units for Fire Protective Signaling Systems
 11. UL 1425: Standard for Cables for Non-Power-Limited Fire-Alarm Circuits
 12. UL 1481: Power Supplies for Fire Protective Signaling Systems
 13. UL 1711: Amplifiers for Fire Protective Signaling Systems
 14. UL 1712: Tests for Ampacity of Insulated Electrical Conductors Installed in the Fire Protective System
 15. UL 1971 Visual Notification Appliances for the hearing impaired.
- D. State building codes, including but not limited to:
1. California Building Code
 2. California Electric Code
 3. California Fire Code
- E. All requirements of the Authority Having Jurisdiction (AHJ).
- 1.4 QUALITY ASSURANCE
- A. The FACP, initiation devices, monitoring devices, control devices, and annunciators shall:
1. Be the product of a single U.S. manufacturer regularly engaged in its manufacture
 2. Share a common communications protocol
- B. All signaling devices shall be the product of a single U.S. manufacturer regularly engaged in its manufacture.
- C. All equipment and accessories shall be new and free from defects.
- D. Equipment and accessories in compliance with the applicable standards listed in Article 1.3 of this section and with applicable national, state and local codes.
- E. Provide surge suppression, refer to Section 264300.
- F. All components shall be UL listed.
- G. All components shall be CSFM listed.
- H. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.
- I. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems, California Electric Code, California Fire Code, and all other state codes. The system shall be electrically supervised and monitor the integrity of all conductors.
- J. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.
- 1.5 SUBMITTALS
- A. Submit under provisions of Section 013000 or 013300.

- B. Submittals shall include the following:
1. Table of contents
 2. A complete set of detailed manufacturer's specifications describing and illustrating all standard and special components and materials
 3. Part numbers
 4. Evidence of compliance with the applicable standards listed under Article 1.3 of this section
 5. Maintenance instructions and intervals
 6. A complete set of drawings for any special items
 7. A single line block diagram showing exactly the manner in which the contractor proposes to layout the system.
 8. Wiring diagrams
 9. Illustrations and scale drawing of the racks, equipment layouts etc.
 10. Drawings shall include designations, dimensions, operating controls, instruments, riser diagrams, routing diagrams etc.
- C. The shop drawing submittal shall include the following:
1. Plans, scale shall match scales of the approved plans
 - a. Site Plan
 - b. Floor Plans
 - 1) Identifying each room's use or occupancy
 - 2) Show device locations
 - 3) Show circuit routing
 2. Diagram of the power circuit.
 3. Riser Diagram, break down by zone or circuit.
 4. Point-to-Point diagram for all devices.
 5. Type of wire being used and that the wire is being run in conduit or FPL rated.
 6. Cut sheets for all devices, highlight actual devices to be used and their amp draw in stand-by and alarm modes.
 7. Current California State Fire Marshall listing sheets
 8. Battery Calculations for 24 hours and 5 minute alarm.
 9. Voltage-Drop Calculations.
 10. Indicate all the California State applicable codes relating to the fire alarm system:
 - a. Section 2-809 and Ch2-72, T-24 CBC.
 - b. Article 3-760, T-24 CEC.
 - c. 2016 Edition of NFPA 72.
 11. Provide documentation from Local Fire Jurisdiction approving Zone breakdown and location of any Fire Alarm Annunciators.
- D. Electronic submittals shall be searchable
- E. The submittal shall be substantially complete for all items and equipment furnished under this section.
- F. Individual drawings and data sheets submitted at random intervals will not be accepted for review.

G. Substitutions

1. Items of same function and performance shall be submitted in conformance with Division 1.
2. All proposed substitutions shall be listed with the California State Fire Marshal.
3. All proposed substitutions shall require approval of the Division of the State Architect.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Submit operation and maintenance manuals in accordance with Section 260000.

B. The manuals shall, at minimum, include the following:

1. Manufacturer (including contact information)
2. Model number
3. Programming manual (where applicable)
4. Wiring diagrams
5. Trouble-shooting guidelines (where applicable)
6. Voltage ratings
7. Current ratings
8. Calibrated range (where applicable)
9. List of capabilities
10. Environmental ratings
11. NEMA enclosure type
12. Maintenance requirements
13. Installation instructions
14. Repair instructions (where applicable)

C. Provide manuals in one of the following formats

1. Three hardcopies
2. PDF

1.7 WARRANTY

A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.8 SUBSTITUTIONS

A. For any proposed substitution a complete description, technical and cost comparison, and test report package shall be submitted to the Owner for review fifteen (15) working days prior to the bid date. Final approval of the substitution item shall be at the option of the Owner, and written notice of the status of the proposed alternative will be supplied to all bidders prior to the final bid date. The Owner or its representative must approve any proposed substitution item in writing. The Owner reserves the right to require a complete sample of any proposed equal item and may, if necessary, request a sample tested by an independent testing consultant to prove equality. The decision of the Owner regarding equality of proposed equal items will be final.

- B. Approved equal status does not imply final acceptance. The Owner prior to the award of bid shall make final acceptance of a substitution item to the successful Contractor, after reviewing the bid information.
- C. If a substitution item is given final acceptance by the Owner, the Contractor shall reimburse the Architect for any additional engineering charges and shall pay all charges of the other trades resulting from the substitution, at no cost to the Owner. This reimbursement shall include all costs required to obtain re-approval from DSA, as the currently specified fire alarm system has been approved in its entirety by DSA.
- D. If a substitution item is given final acceptance by the Owner, the Contractor shall pay all charges (including travel, lodging, meals, etc.) required to provide factory certification, equal to that of a Factory Authorized Distributor of the substituted item, for two (2) selected Owners representatives. This training shall occur at the primary factory of the substituted item in question and shall allow the selected Owners representatives to provide any and all Factory/Manufacturer Approved repairs, services, software upgrades, etc. without affecting any available or applicable Manufacturer Warranties.
- E. All of the equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment with the most current software package available at the time of installation. At the time of Owner Acceptance of the installation, all equipment shall include any and all updated software revisions. In addition, when the software is available in disk format, a backup copy of the most up to date revision, in disk format, shall be handed to the Owner at the completion of the project.

1.9 POST CONTRACT MAINTENANCE

- A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.
- B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, tests, and repairs described below. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.
- C. Maintenance and testing shall be on a semiannual basis or as required by the AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:
 - 1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
 - 2. Each circuit in the fire alarm system shall be tested semiannually.
 - 3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 14.

1.10 POST CONTRACT EXPANSIONS

- A. The contractor shall have the ability to provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.
- B. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules and addressable modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).
- C. The quotation shall include installation, test labor, and labor to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labor necessary to install this hardware.
- D. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices or notification appliances connected to the addressable monitor/control modules.
- E. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL

- A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.
- B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.
- D. Fire alarm control panel: The contractor shall furnish and install all FACP accessories needed for the FACP to perform the following.
 - 1. Connect to all initiation and notification circuits shown on plans
 - 2. Network with other FACPs, annunciators, etc.
 - 3. Communicate with remote monitoring station
- E. Refer to plans for manufacturer(s), devices types and models to be used.

2.2 FIRE ALARM CONTROL PANEL (FACP)

- A. All fire alarm systems shall have one main FACP. Systems with more than one FACP will have main FACP indicated on plans. If it is not on plans, it is FACP in administration building.
- B. All satellite FACPs shall include the following equipment:
 - 1. Central processing unit
 - 2. Signaling line circuit (addressable initiation devices) interface(s)
 - 3. Notification appliance circuit interface(s)
 - 4. Network communications module(s)
 - 5. User interface
 - a. 80 character, backlit LCD display
 - b. Buttons
 - 1) Acknowledge
 - 2) Signal Silence
 - 3) Drill
 - 4) System Reset
 - 5) Lamp Test
 - c. QWERTY keyboard
 - 6. Power supply (sized for all loads)
 - 7. Battery charger (sized for all loads)
 - 8. Batteries (sized for all loads)
 - 9. All accessories necessary for a fully functional system
- C. The main FACP shall include the following in addition to satellite FACP requirements.
 - 1. User interface
 - a. LCD display shall be 640 characters.
 - b. Additional buttons
 - 1) Fire Alarm Scroll/Display
 - 2) Security Scroll/Display
 - 3) Supervisory Scroll/Display
 - 4) Trouble Scroll/Display
 - 5) Other Event Scroll/Display
 - 6) Print Screen
 - 7) Next/Previous Section
 - 8) Battery Level
 - c. If the fire alarm system has a remote annunciator meeting user interface, the main FACP's user interface may be same as satellite FACP requirements.
 - 2. Digital alarm communicator transmitter
 - 3. Internet Protocol media access card
 - 4. Computer interface software or firmware
- D. The FACP and all accessories shall be housed in a cabinet size for all equipment.

2.3 FIRE ALARM DEVICES

- A. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall use the photoelectric (light-scattering) 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. Refer to the fire alarm drawings fire alarm symbols list for device manufacture and model number.

- B. Addressable Multi-Criteria Photo/CO Detectors: UL 268 7th edition standard for smoke detection and UL 2075 standard for system-connected life safety carbon monoxide detection. B200S series intelligent sounder bases generate either Temp 3 patten for fire or a Temp 4 pattern for CO alarm. Refer to the fire alarm drawings fire alarm symbols list for device manufacture and model number.
- C. Intelligent Thermal Detectors: The intelligent thermal detectors shall be addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit. Refer to the fire alarm drawings fire alarm symbols list for device manufacture and model number.
- D. Intelligent Addressable Reflected Beam Detector. The intelligent single-ended reflected beam smoke detector shall connect with two wires to the fire alarm control panel signaling line circuit (SLC). The detectors shall consist of a transmitter/receiver unit and a reflector and shall send data to the panel representing the analog level of smoke density. The detector shall be capable of being tested remotely via a keyswitch. Refer to the fire alarm drawings fire alarm symbols list for device manufacture and model number.
- E. Addressable Manual Fire Alarm Box (manual station)
 - 1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the address-able communication module status. They shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except using a key. Refer to the fire alarm drawings fire alarm symbols list for device manufacture and model number.
 - 2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
 - 3. Manual fire alarm boxes shall have clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.
- F. Addressable Dry Contact Monitor Module: Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs. Refer to the fire alarm drawings fire alarm symbols list for device manufacture and model number.
- G. Addressable Relay Module
 - 1. Addressable Relay Modules shall be available for HVAC control and other network building functions; Refer to the fire alarm drawings fire alarm symbols list for device manufacture and model number.
 - 2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary devices energize at the same time on the same pair of wires.
- H. Horn Strobes: The horn strobe shall be listed to UL 1971 and be approved for fire protective signaling systems. The strobe shall feature selectable candela output and be fully synchronized. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances. Refer to the fire alarm drawings fire alarm symbols list for device manufacture and model number.
- I. Strobes: Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and be fully synchronized. The strobe shall feature selectable candela output. Refer to the fire alarm drawings fire alarm symbols list for device manufacture and model number.
- J. Horn-Weatherproof
 1. Provide low profile weatherproof Horn at the locations shown on the drawings. Refer to the fire alarm drawings fire alarm symbols list for device manufacture and model number.
 2. A factory supplied back box shall be supplied for weatherproof applications.
- K. Annunciator: The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. Refer to the fire alarm drawings fire alarm symbols list for device manufacture and model number.
- L. Communicator: A communicator with backup battery option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet or Cellular network to a compatible receiver. Refer to the fire alarm drawings fire alarm symbols list for device manufacture and model number.

2.4 CONDUIT AND WIRE

- A. Conduit
 1. Conduit shall be in accordance with The California Electrical Code (CEC), local and state requirements.
 2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
 3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per CEC Article 760-55.
 4. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
 5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
 6. Conduit shall be 3/4-inch (19.1 mm) minimum.

- B. Wires/Cables
 - 1. All fire alarm system wiring shall be new.
 - 2. Wiring shall be in accordance with local, state and national codes (e.g., CEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 12 AWG.
 - 3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
 - 4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in CEC (e.g., FPLR).
 - 5. Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
 - 6. All field wiring shall be electrically supervised for open circuit and ground fault.
 - 7. The fire alarm control panel shall be capable of t-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems that do not allow or have restrictions in, for example, the amount of t-taps, length of t-taps etc., are not acceptable.
 - 8. All wires shall be listed by the California State Fire Marshal (CSFM).
- C. Terminal Boxes, Junction Boxes and Cabinets. All boxes and cabinets shall be UL listed for their use and purpose.
- D. Initiating circuits shall be arranged to serve like categories (manual, smoke, waterflow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.
- E. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.
- F. All fire alarm cables shall be listed with the California State Fire Marshal for use in a fire alarm system.

2.5 BATTERIES

- A. The battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 15 minutes of alarm upon a normal AC power failure.
- B. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.
- C. If necessary to meet standby requirements, external battery and charger systems may be used.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the CEC, NFPA 72, and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.
- E. All fire alarm devices shall be labeled with adhesive markers to indicate their respective addresses and/or device ID to match the fire alarm riser diagram.

3.2 ON-SITE START-UP

- A. System Check: Prior to energizing any part of this system, the factory authorized representative shall check thoroughly the installation, and perform pre-start checks. This representative shall check all points, fire alarm panels and complete network to ensure proper operation and make any needed repairs and/or replacements required. Sufficient time shall be included in the project bid to cover all required start-up assistance and testing.
- B. Testing: The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 14.
 - 1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
 - 2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
 - 3. Verify activation of all waterflow switches.
 - 4. Open initiating device circuits and verify that the trouble signal actuates.
 - 5. Open and short signaling line circuits and verify that the trouble signal actuates.
 - 6. Open and short notification appliance circuits and verify that trouble signal actuates.
 - 7. Ground all circuits and verify response of trouble signals.
 - 8. Check presence and audibility of tone at all alarm notification devices.
 - 9. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.
 - 10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper

processing of the signal at the FACP and the correct activation of the control points.

11. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.
 12. The completed smoke detection system shall be tested to insure that it is operating properly. Acceptance of the system shall also require a demonstration of the stability of the system. This shall be adequately demonstrated if the system operates for a ninety (90) day test period without any unwarranted alarms. Should an unwarranted alarm(s) occur, the contractor shall readjust or replace the detector(s) and begin another ninety (90) day test period. As required by the architect, the contractor shall recheck the detectors after each readjustment or replacement of detectors. This test shall not start until the owner has obtained beneficial use of the building under tests.
- C. All test and report costs shall be in the contract price. A checkout report shall be prepared by the installation technicians and submitted in triplicate, one copy of which will be registered with the equipment manufacturer. The report shall include, but not be limited to:
1. A complete list of equipment installed and wired.
 2. Indication that all equipment is properly installed and functions and conforms with these specifications.
 3. Test of individual zones as applicable.
 4. Serial numbers, locations by zone and model number for each installed detector.
 5. Voltage (sensitivity) settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.
 6. Response time on thermostats and flame detectors (if used).
 7. Technician's name, certificate number and date.
 8. NFPA Certification shall be completed, signed, and submitted.
- D. The completed fire alarm system shall be tested to insure that it is operating properly. Acceptance of the system shall also require a demonstration of the stability of the system. This shall be adequately demonstrated if the system operates for a ninety (90) day test period without any unwarranted alarms. Should an unwarranted alarm(s) occur, the contractor shall readjust or replace the detector(s) and begin another ninety (90) day test period. As required by the architect, the contractor shall recheck the detectors after each readjustment or replacement of detectors. This test shall not start until the owner has obtained beneficial use of the building under tests.

3.3 FINAL INSPECTION

- A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4 INSTRUCTION

- A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."
- C. Appropriate quantities of installation and operation manuals shall be provided and used for instructional purposes.

3.5 RECORD DRAWINGS AND OPERATING MANUALS

- A. After completion of all the tests and adjustments listed above, the contractor shall submit the following information to the architect:
 - 1. "As-built" conduit and cable layout diagrams including wire color code and/or tag number.
 - 2. Complete "as-built" site plans, floor plans, wiring diagrams, and calculations
 - 3. Detailed catalog data on all installed system components.
 - 4. Copy of the test report.
- B. Operating Manual:
 - 1. Before final acceptance of work, the contractors shall deliver five copies of a composite "Operating and Shop Maintenance Manual." Each manual shall contain, but not be limited to a statement of guarantee including date of installation and name and phone number of the person to be called in the event of equipment failure.
 - 2. Individual factory issued manuals shall contain all technical information on each piece of equipment installed. In the event such manuals are not obtainable from the factory, it shall be the responsibility of the contractor to compile and include them. Advertising brochures or operational instructions shall not be used in lieu of the required technical manuals.
- C. Upon completion and testing of the fire alarm system, provide the NFPA certificate to the owner, local fire official, architect, and DSA.

END OF SECTION

SECTION 310513 - SOIL FOR EARTHWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavated (and re-used) materials and imported materials.

1.2 RELATED SECTIONS

- A. City of Fresno Standard Specifications
- B. Division 31
- C. Section 329300 – Planting

1.3 REFERENCES

- A. A Geotechnical Engineering Report was performed for this project by Fresno County. report No. T90203, dated 4-22-2020.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013300 Submittal Procedures
- B. Samples: Submit, in air-tight containers, 10 lb. of Type S3, S4, and S5 fill to inspector.
- C. Soil Analysis: Submit for Type S3 and S4 soils to be imported.
- D. Materials Source: Submit location of imported materials source. Provide materials from same source throughout the work. Change of source requires approval.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Soil Type S1: Excavated and re-used material, graded; free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
- B. Soil Type S2: Excavated and reused material graded; free of roots, lumps greater than one inch, rocks larger than ½ inch, debris, weeds and foreign matter.
- C. Soil Type S3: Imported topsoil, friable loam; reasonably free of roots, rocks larger than ½ inch, debris, weeds, and foreign matter.
- D. Soil Type S4: Imported borrow, non-expansive, granular material, suitable for purposes intended, free of vegetable matter and other unsatisfactory material, and required as follows:

| | |
|-----------------------------|--------|
| Maximum Particle Size: | 3" |
| Percent Passing #4 Sieve: | 75-100 |
| Percent Passing #200 Sieve: | 10-30 |

| | |
|---------------------|------------------|
| Expansion Index | <15 |
| Plasticity Index | <15 |
| Organics: | <3% by Weight |
| Sulfates: | <0.05% by Weight |
| Minimum Resistivity | >8,000 ohms-cm |
| Minimum R Value | 50 |

- E. Soil Type S5: Imported sand. Natural river or bank sand washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
- F. Hard Pan: Hard pan soils were encountered within the upper 6" to depths of approximately 6-1/2" feet. Hard pan soils may be used as engineered fill if the hard pan soils are broken down to a maximum particle size of 3" and blended with soil types S1, S2 or S4 of this Section 31 05 13. Over-sized material should be removed from the fill soils as necessary to establish a well graded fill material.
- G. All soil material used must come from/be within a mile 5 radius of the site.

2.2 SOURCE QUALITY CONTROL

- A. Inspection of imported soil will be performed by the Construction Manager at source of import and prior to being delivered to the site.

PART 3 - EXECUTION

3.1 STOCKPILING

- A. Temporarily stockpile excavated or imported material onsite at location designated by Construction Manager.
- B. Stockpile excavated or imported material in sufficient quantities to meet project schedule and requirements.

3.2 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free-standing surface water.
- B. Dispose of excess material off-site.

END OF SECTION 310513

SECTION 312200 - GRADING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavating soil and other material for surface improvements.
- B. Placing fill.
- C. Compaction of existing ground and fill.
- D. Preparation of subgrade for other improvements.
- E. Grading of soil.

1.2 RELATED SECTIONS

- A. City of Fresno Standard Specifications
- B. Division 31

1.3 REFERENCES

- A. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- B. A Geotechnical Engineering Report was performed for this project by Fresno County. report No. T90203, dated 4-22-2020.

1.4 DEFINITIONS

- A. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

- A. Submit in accordance Section 013300 Submittal Procedures
 - 1. Product Data:
 - a. Information indicating the source of all import material, the fill material type and where it is to be used.
 - 2. Quality Assurance/Control:
 - a. Material Test Reports:
 - 1) Classification of Soils.
 - 2) Compaction Characteristics of Soils.
 - 3) Density and Unit Weight of Soils in Place.

3. Final Inspection:
 - a. Drawings indicating the extent and depth of all engineered fill. This information shall be a part of the Project "As-Built" and Project "Record" Documents in accordance with Section 017700 Closeout Submittals.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Installer:
 - a. Engage an experienced Installer who has successfully completed three (3) projects of similar scope and size to that indicated for this project.

B. Regulatory Requirements:

1. In accordance with the following:
 - a. CARB Materials and equipment used for this Project shall comply with the current applicable regulations of the California Air Resources Board [CARB] and the Environmental Protection Agency [EPA].
 - b. CAL/OSHA Comply with all provisions of the Construction Safety Orders and the General Safety Orders of the California Division of Occupational Safety and Health, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground excavations.
 - c. CF City of Fresno, Codes and Ordinances
 - d. EPA Environmental Protection Agency.
 - e. SWRCB State Water Resources Control Board

C. Certificates:

1. Installer's certification that all Earthwork installation meets or exceeds the requirements of this specification.
2. Contractor's certification (on Contractor's letterhead paper) that the Earthwork materials and installation meets or exceeds the requirements of this specification.

D. Meetings:

1. Pre-Installation: Schedule with Construction Manager prior to the start of work.
 - a. Coordinate the work with other work being performed.
 - b. Identify any potential problems, which may impede planned progress and proper installation of work regarding quality of installation and warranty requirements.
2. Progress: Scheduled by the Contractor with Construction Manager during the performance of the work.
 - a. Review for proper installation of work progress.
 - b. Identify any installation problems and acceptable corrective measures.
 - c. Identify any measures to maintain or regain project schedule if necessary.
3. Completion: Scheduled by the Contractor with Construction Manager upon proper completion of the work.
 - a. Inspect and identify any problems which may impede issuance of warranties or guaranties.

- b. Maintaining installed work until the Notice of Substantial Completion has been filed.

1.7 COORDINATION

- A. Coordinate work with Construction Manager.
- B. Verify that the location of existing utilities have been indicated at work site by utility authorities.

1.8 EXISTING CONDITIONS

- A. Hard pan soils were encountered within the upper 6" of existing soils to depths of approximately 6-½ feet. It is anticipated that the hard pan layers will be exposed during excavation, digging and drilling activities. The Contractor must work with and mitigate this existing condition at no additional cost to the Owner.
- B. Existing Conditions:
 - 1. Examine site and verify conditions with the Drawings and Specifications. Contractor shall familiarize himself with existing site conditions and any changes that have occurred at the site since the preparation of the contract documents and shall be responsible to account for any such changes in the price bid for this work.
 - 2. Thoroughly investigate and verify conditions under which the Work is to be performed.
 - 3. Locate and identify utilities:
 - a. Call a Local Utility Locator Service ("Underground Service Alert" (USA) – 811) for the task of locating any applicable off-site and on-site utilities in the area where the Project is located.
 - 4. No allowance for extra Work will be granted resulting from negligence or failure to meet requirements of Article titled "Existing Conditions" above.
- C. Where subsurface work involves more than the normal depth of excavation required for the removal and/or construction of surface improvements (surface improvements such as concrete work, paving, landscaping, signs, etc.), the owner has made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- D. Under similar circumstance to Section 31 22 00/1.8C., service laterals and appurtenances will have also been shown where information was available as to their location. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

- E. Determine exact location of existing buried utilities by:
 - 1. Marking on ground or pavement surface the alignment and extent of the facilities and the probable location of existing utilities using construction plans and existing surface features.
 - 2. Requesting "Underground Service Alert" (USA) at [800] 227-2600 to indicate location of existing buried facilities. Provide USA a minimum of two (2) working days of notice of request for locations, and notify Owner of said request concurrently.
 - 3. Locate exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.
- F. At proposed work location, expose by hand methods (or vacuum equipment) all existing utilities along the route of the proposed work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand (or vacuum equipment) methods to locate all existing facilities as indicated on the plans, and/or as indicated on the ground by USA or Owner's personnel.
- G. Provide Field Engineering, or "As-Built" drawings, to record the location of all utilities encountered. Where locational conflicts exist between existing utilities and the planned location of facilities to be constructed under this Contract, submit detailed information to the Construction Manager for review and direction.
- H. Maintain all existing utility mains and service lines in constant service during construction of the Work.
- I. Where service disruptions are allowed, minimize the length of such disruptions by proper scheduling and diligent pursuit of the work.
- J. Native soils have been classified as "corrosive" to metal objects. Provide approved wrap or coating for all metallic objects that will be in contact with soil.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Dust control: Perform work in a manner as to minimize the spread of dust and flying particles. Thoroughly moisten all surfaces as required to prevent dust from being a nuisance to the public, neighbors and concurrent performance of other on-site work.
 - 1. All disturbed areas, including storage piles, which are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using water, chemical stabilizer/suppressant, or vegetative ground cover.
 - 2. All on-site unpaved roads shall be effectively stabilized of dust emissions using water or chemical stabilizer/suppressant.
 - 3. All land clearing, demolition, grubbing, scraping, excavation, land leveling, grading, and cut and fill activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by presoaking.
 - 4. When materials are transported off-site, all material shall be covered, effectively wetted to limit visible dust emissions or at least six inches of freeboard space from the top of the container shall be maintained.
 - 5. All operations shall limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at least once every 24 hours when operations are

occurring. The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions. The use of blower devices is expressly forbidden.

6. Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions utilizing sufficient water or chemical stabilizer/ suppressant.
 - a. Contractor shall comply with all requirements of the San Joaquin Valley Air Pollution Control District (SJVAPCD) for construction activity related to this project.
 - b. A Dust Control Plan, as required by the SJVAPCD, may be required for this project. If required, Contractor shall be responsible for preparing said Dust Control Plan, submitting to the SJVAPCD for review and approval, and paying all SJVAPCD review and permitting fees related to the Dust Control Plan.
 - c. If a dust control plan is required, no construction activity related to this project may begin until Contractor has secured an approved Dust Control Plan.
 - d. Contractor shall be solely responsible to implement all requirements of the Dust Control Plan throughout the life of this contract.
 - e. Should fines or fees be levied against the Project for violations of the Dust Control Plan and/or related SJVAPCD regulations, Contractor shall be responsible to pay all said fines or fees and to implement all mitigation measures required by SJVAPCD in order to bring the construction activity into compliance with SJVAPCD regulations. The costs for any such fines or fees shall be included in the lump sum price bid for work under this contract and no additional payment will be made therefore
- B. Burning: No burning will be allowed on-site.
- C. Rain: Work under this section shall not be started or maintained under threat of rain, unless the work is not affected by the rain.
- D. Do not place fill during weather conditions which will alter moisture content of fill materials sufficiently to make compaction to the specified densities difficult or impossible.
- E. When reference is made to SWPPP (Storm Water Pollution Prevention Plan, if any within this Project Manual), then comply with all environmental protection requirements included therein.
- F. In accordance with EPA and CF.
- G. Protection:
 1. Protect cut and fill areas to prevent water running into excavation. Maintain areas free of water. Remove seeping water immediately by pumps.
 2. Protect cut slopes from erosion due to precipitation and other sources of runoff.
 3. Protect utilities to remain within the construction area and special construction. If utility lines are uncovered (water, electric, sewer, etc.) not shown on the drawings during excavation of site, notify the Construction Manager promptly for its review and action.
 4. Do not permit access to undeveloped portions of the site, nor to areas that are outside of the limits of grading.

5. Tree Protection:
 - a. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Do not permit construction materials, debris, excavated materials, vehicles, equipment, or foot traffic within the drip line of the fenced trees. Remove fence when construction is complete.
 - b. Do not excavate within drip line of trees, unless otherwise indicated. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible. Cover exposed roots with burlap, water regularly, and backfill as soon as possible. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil. Coat cut faces of roots more than 1-1/2 inches (38 mm) in diameter with emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 - c. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by the Construction Manager and employ a qualified arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.

1.10 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 017700 Closeout Submittals.
- B. Accurately record actual locations of utilities encountered including depth and horizontal location, as measured from permanent site features.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fill in Turf or Other Planting Areas: Type S2 or S3 per Section 31 05 13, and as required by Section 31 05 13
- B. Fill in Non-planting Areas: Type S1, S2 or S4 per Section 31 05 13

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify site conditions.

3.2 PREPARATION

- A. Layout of Work:
 1. Contractor shall be responsible for all lines and grades.

2. Check all bench marks, monuments and property lines and verify locations.
 3. Locate and maintain all grade stakes.
 4. Monuments moved, damaged or displaced during grading operations are to be replaced by a California Registered Civil Engineer or Surveyor, at Contractor's expense.
- B. Locate, identify, and protect existing above and below grade utilities from damage.
- C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.
- D. Protect existing structures, fences, curbs, sidewalks, paving and other improvements to remain from damage from excavation equipment and vehicular traffic.
- E. Employ equipment and methods appropriate to the work site.
- F. Protect excavated areas from drainage inflow, and provide for drainage of all excavated areas.
- G. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.
- H. Complete clearing and grubbing and site demolition as specified. Vegetation, root balls, trash, debris, fill material, and the near-surface soils containing objectionable organic material should be stripped and hauled off-site or used as finish fill in landscape areas.

3.3 EXCAVATION

- A. Hard Pan: It is expected that hard pan soils will be exposed during excavation. If the hard pan soil meets the satisfaction of the Construction Manager the contractor may build on top of the hard pan layers. If the hard pan soil layers do not meet the satisfaction of the Construction Manager the contractor will be required to remove the hard pan soil at no additional cost to the owner.
- B. Excavate soil to finish subgrade of improvements (or layer thereof) to be placed thereon, or to finish surface grade where no improvements are to be placed thereon.
- C. Conform excavation to the lines, grades and cross-sections shown on the plans.
- D. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw.
- E. Remove excess soil not to be used as fill in the Work from the site. Unless requested by Construction Manager to be deposited at a site designated by Construction Manager on the property, obtain a disposal site and legally dispose of said excess material, all at no additional cost to the Owner.

3.4 FILLING AND COMPACTING

- A. Clear all debris, vegetable matter and other deleterious material from areas to receive fill.

- B. Prior to filling, complete overexcavation as described in Section 312200/3.3, and prepare the surface as specified in Section 312200/3.5.
- C. On existing slope areas steeper than 8 horizontal to 1 vertical, plow or scarify existing surface to a depth of 8" prior to filling to produce a bond with the material to be placed.
- D. Place and compact soil fill to finish subgrade of improvements (or layer thereof) to be placed thereon, or to finish surface grade where no improvements are to be placed thereon.
- E. In areas to receive non-vegetative surface improvements, place fill in uniform layers not exceeding 8-inches in uncompacted thickness, moisture condition to 3% above optimum moisture content and compact to a minimum of 92% relative compaction to within 12-inches of finished grade or subgrade, aggregate base, or concrete surface. The top 12-inches shall be compacted to 95% relative compaction.
- F. In areas to receive vegetation, place fill in uniform layers not exceeding 8-inches in uncompacted thickness, moisture condition to 3% above optimum moisture content and compact to a minimum of 92% relative compaction up to 12-inches below finished grade and obtain 85% relative compaction in the top 12-inches.
- G. Conform fill to the lines, grades and cross-sections shown on the plans.
- H. Maintain optimum moisture content of fill materials to attain required compaction density.
- I. Fill materials to conform to Section 312200/2.1.
- J. Provide, at no additional cost to Owner, imported soil material conforming to the requirements of Section 312200/2.1, as needed to attain finished grades of Work.
- K. Fill material placed beneath areas to receive asphalt concrete pavement shall have a minimum R-Value of 50.
- L. Utilize equipment which will not disturb or damage existing utilities and other improvements.
- M. Buried metallic objects shall have a protective coating or wrap to prevent direct contact with soil.

3.5 PREPARATION OF SUBGRADE FOR SURFACE IMPROVEMENTS

- A. Where concrete, asphalt-concrete, aggregate base, or other non-vegetative surface improvements, or a layer of said surface improvements, are to be constructed on the soil surface, prepare the subgrade for said improvements in accordance with this section.
- B. Scarify the ground surface to a minimum depth of 12-inches, moisture condition to 3% above optimum moisture content, and compact to at least 95% relative compaction.
- C. Thoroughly moisture condition, mix, roll and compact to the relative compaction specified herein.

- D. Prior to commencing construction of surface improvements, pass a test roller of size and weight as approved by the Construction Manager over the subgrade to establish the extent of soft or spongy areas requiring repairs. Subgrade material in such areas shall be removed and replaced to the satisfaction of the Construction Manager. No additional payment will be made for test rolling or the correction of subgrade deficiencies identified thereby.
- E. Conform finished subgrade surface to the lines, grades and cross-sections shown on the plans.

3.6 FINE GRADING

- A. Fine grade all finished surfaces to the lines, grades and cross-sections shown on the plans, and to blend to hard surface improvements.
- B. Rake and smooth all finished surfaces not to receive hard surface improvements.

3.7 TOLERANCES

- A. Top surface of Subgrade for Non-Vegetative Surface Improvements or Layers thereof: Plus or minus 0.02 feet from planned elevation.
- B. Top surface of Subgrade for Vegetative Surface Improvements or for Bare Ground - Plus or minus 0.05 feet of planned elevation, or as required for finish surface to match adjacent improvements or ground.

3.8 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of the City of Fresno Standard Specifications.
- B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.
- C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest.
- D. All retesting required as a result of failure of initial test will be at the expense of the Contractor.
- E. Where graded surfaces are not within the tolerances of this section, correct out of tolerance areas and resurvey prior to submitting final as-graded survey.

END OF SECTION 312200

SECTION 321723 - PAINT AND MARKING SITE SURFACE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnishing and installing painted parking stall, traffic marking and wording on asphaltic-concrete surfaces.
- B. Furnishing and installing accessible marking and hatching area on asphaltic-concrete pavement.

1.2 RELATED SECTIONS

- A. City of Fresno Standard Specifications
- B. Section 321200 - Flexible Paving.
- C. Section 033000.1 – Site Cast-in-place Concrete.

1.3 REFERENCES

- A. SSCDOT - Standard Specifications, California Department of Transportation (Caltrans), latest edition, except for references to methods of payment and to furnishing of materials by State.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013300 Submittal Procedures.
- B. Certificates of compliance for material.

1.5 COORDINATION

- A. Coordinate work with other work, including associated traffic signing.
- B. Commence striping or marking of asphaltic-concrete no sooner than 5 days following any sealing of the asphaltic-concrete, or as recommended by seal coat manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Paint: Quick drying, high visibility water soluble acrylic striping paint; Stripe Master, Wikel Mfg. Company, or similar by Sherwin Williams or approved equal.
- B. Paint shall be of color indicated on the construction plans.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that site is ready for application.

3.2 PREPARATION

- A. Identify installation locations. Install parking stall striping, traffic marking, wording, accessible symbol and access striping at locations, as shown on construction plans.
- B. Thoroughly clean all surfaces to be painted.
- C. Employ equipment and methods appropriate to the work site.

3.3 INSTALLATION

- A. Apply paint striping and marking as indicated on the plans.
- B. Apply paint uniformly, straight and true, with equipment designed for traffic striping and marking applications.
- C. Apply paint striping and marking per Section 84 of SSCDOT.
- D. Apply a minimum of 2 coats of paint at all striping and marking locations, including asphaltic-concrete and concrete surfaces.

END OF SECTION 321723

SECTION 331000 - WATER UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pipe and fittings for on-site domestic piping.
- B. Valves and valve boxes.
- C. Accessories.

1.2 RELATED SECTIONS

- A. City of Fresno Standard Specifications
- B. Division 31
- C. Section 033000.1 – Site Cast-in-Place Concrete.

1.3 REFERENCES

- A. ASTM Test Method D1557.
- B. ANSI/ASTM D2466 - Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
- C. ANSI/AWWA C110 - Ductile Iron and Grey-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids.
- D. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- E. ANSI/AWWA C500 - Gate Valves, 3-inch through 48-inch NPS, for Water and Sewage Systems.
- F. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water.
- G. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and Class 200.
- H. ASTM D2855 - Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.
- I. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

1.4 SUBMITTALS

- A. Submit in accordance with Section 013300 Submittal Procedures

- B. Product Data: Provide data on pipe materials, pipe fittings, valves, backflow preventor and accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 017700 Closeout Submittals
- B. Accurately record actual locations of piping mains, valves, connections and appurtenances, referenced to permanent surface features.
- C. Identify and describe discovery of uncharted utilities or utilities found at locations different than indicated on plans.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with product manufacturer's recommendations and these Contract Documents.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle all products required.

PART 2 - PRODUCTS

2.1 WATER PIPE

- A. Ductile Iron Pipe (for iron pipe larger than 3 inches in diameter, above ground): ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, thickness Class 50, with cement - mortar lining and seal coating per ANSI/AWWA C104/A21.4.
 - 1. Fittings: ANSI/AWWA C110/A21.10, ductile iron.
 - 2. Joints: Flanged.
- B. PVC Pipe (for pipe 3 inches and smaller, underground): ASTM D1785, Schedule 40; 1120 high impact.
 - 1. Fittings: ANSI/ASTM D2464, Schedule 80 PVC (Schedule 40 PVC for pipes 1-1/2 inches and smaller).
 - 2. Joints: ASTM D2855, solvent weld.
- C. PVC Pipe (for pipe 4 inches and larger, underground): ANSI/AWWA C900 Class 200, 1120 high impact.
 - 1. Fittings: ANSI/AWWA C111, cast iron.
 - 2. Joints: ASTM D3139 compression gasket ring.

2.2 GATE VALVES - Up to 2 Inches (50 mm)

- A. Use full port ball valves for 2 inches and smaller and gate valves for 2-1/2 inches and larger size.
- B. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends.

2.3 WATER METER AND BACKFLOW PREVENTOR

- A. Water Meter – Per City of Fresno Standard Specifications.
- B. Backflow Preventor – Per manufacturer's and City of Fresno Specifications.

2.4 VALVE BOXES

- A. Precast Reinforced Concrete. Cast iron lid marked for service. Christy No. G5 or approved equal.

2.5 ACCESSORIES

- A. Concrete for Thrust Blocks and Valve Box Surface Collars: Concrete type specified in Section 033000.
- B. Valve Boxes and Covers: Christy No. G5 traffic box, or approved equal. Cover marking shall read "Water". A one-piece PVC riser extension shall be provided as necessary to allow unobstructed access to valve operating nut.
- C. Solvent Cement and Primer for PVC Pipe and Fittings: Per ASTM F656 and ASTM D2564.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions. All plot dimensions are approximate. Before proceeding with any work, carefully check and verify all dimensions and report any variations to the Construction Manager.
- B. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. Carefully investigate the structural and finished conditions affecting all work, and plan work accordingly, furnishing such fittings, etc., as may be required to meet such conditions. Unless dimensions are shown, drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner, so that conflicts between water systems, planting, and architectural features will be minimized.
- C. Do not install the facilities as indicated on the drawings when it is obvious in the field that unknown obstructions might not have been considered in the engineering. Such obstructions or differences should be brought to the attention of the Construction Manager before proceeding.

3.2 PREPARATION

- A. Prepare for pipe installation by assembling all needed materials.
- B. Cover all PVC pipe during storage.

3.3 BEDDING

- A. Excavate trench, pit or hole in accordance with Section 31 23 00.
- B. Where trench or pit has been over excavated, place bedding material at bottom of excavations, level soil materials in continuous layers not exceeding 6 inches uncompacted depth.
- C. Backfill around sides and to a level 6 inches above the top of pipe with bedding sand, tamped in place.
- D. Maintain optimum moisture content of bedding material to attain required compaction density.

3.4 INSTALLATION - PIPE AND FITTINGS

- A. Install pipe at locations and depths indicated on plans.
- B. Install pipe, fittings, and associated materials in accordance with manufacturer's recommendations.
- C. Route pipe in straight line, whenever possible. All changes in direction of pipes shall be made with fittings, not by bending.
- D. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- E. Form and place concrete for thrust blocks at each elbow, tee, angle or other significant change of direction in loose-joint pipe, per detail on plans.
- F. Establish elevations of buried piping to ensure not less than 24 inches of cover, except at connections to existing lines, which may be shallower or deeper, or where shown otherwise on plans.
- G. When two water pipes are to be installed in same trench, maintain 4-inch horizontal clearance between pipes.
- H. Connect water facilities to Prefabricated Building.
- I. Backfill trench or other excavation in accordance with Section 312300.

3.5 INSTALLATION - VALVES

- A. Set valves on solid bearing.
- B. Where valves are installed below finish surface grade, center and plumb valve box and any necessary extensions over valve. Set box cover flush with finished grade.

- C. Pour concrete collar around top of valve box per detail on plans.
- D. Furnish and install valves and valve boxes in addition to those shown on plans as required for isolation of lines for construction and disinfection, while minimizing disruption of service to buildings, at no additional cost to the Owner.

3.6 INSTALLATION - THREADED CONNECTIONS

- A. Assemble all plastic and galvanized steel threaded pipe and fittings using an approved Teflon tape applied to the male threads only. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved Teflon tape will be required.
- B. At all plastic (PVC) pipe connections, work the ductile iron connections first. Connections shall always be plastic into steel, never steel into plastic.
- C. A non-hardening sealant and lubricant similar to Permatex #51, LASCO blue pipe sealant, or approved equal may be used in lieu of Teflon tape. Apply sealant to clean male threads brushing into grooves and to the first three threads of the female threads.

3.7 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect all domestic water piping systems in accordance with AWWA Standard C601, "AWWA Standard for Disinfecting Water Mains", and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and witnessed by the Owner's Inspector. During procedure, signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, water samples shall be collected for bacteriological analysis. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner.

3.8 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of the City Standard Specifications.
- B. Compaction testing of bedding and backfill will be performed in accordance with ANSI/ASTM D1557.
- C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest. Any retests required due to failure of initial tests shall be paid for by the Contractor.

END OF SECTION 331000

SECTION 333000 - SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Locating existing utilities.
- B. Excavating trenches for sanitary sewer facilities.
- C. Furnishing and installing sanitary sewer facilities, including pipe, cleanouts, services, and associated facilities.
- D. Placing and compacting pipe bedding.
- E. Final backfilling, compaction and grading.

1.2 RELATED SECTIONS

- A. City of Fresno Standard Specifications
- B. Division 31
- C. Section 033000.1 – Site Cast-in-Place Concrete.

1.3 REFERENCES

- A. American Water Works Association (AWWA)
- B. ANSI/ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- C. ANSI/ASTM D3034 - Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, 4-inch to 15-inch.

1.4 DEFINITIONS

- A. Bedding: Fill placed under, around, beside and directly over pipe, prior to subsequent backfill operations.
- B. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

- A. Submit under provisions of Section 013300 Submittal Procedures.
- B. Certificates of compliance for material.

- C. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.
- D. Manufacturer's Installation Instructions: Indicate special procedures required to install products supplied.

1.6 COORDINATION

- A. Coordinate work with Owner's personnel.
- B. Verify that the location of existing utilities have been indicated at work site by utility authorities or Owner's personnel.
- C. Coordinate work with other project work.

1.7 EXISTING UTILITIES

- A. Existing Conditions:
 - 1. Examine site and verify conditions with the Drawings and Specifications. Contractor shall familiarize himself with existing site conditions and any changes that have occurred at the site since the preparation of the contract documents and shall be responsible to account for any such changes in the price bid for this work.
 - 2. Thoroughly investigate and verify conditions under which the Work is to be performed.
 - 3. Locate and identify utilities:
 - a. Call a Local Utility Locator Service ("Underground Service Alert" (USA) – 811) for the task of locating any applicable off-site and on-site utilities in the area where the Project is located.
 - b. .
 - 4. No allowance for extra Work will be granted resulting from negligence or failure to meet requirements of this Article.
- B. The Engineer has made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- C. Under circumstance similar to 333000/1.7b, service laterals and appurtenances will have also been shown where information was available as to their location. In many cases, however, the only available information relative to the existing location of said facilities may have been small scale undimensioned plats. The locations of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- D. Determine exact location of existing buried utilities by:
 - 1. Marking on ground or pavement surface the alignment and extent of the proposed facilities and the probable location of existing utilities using construction plans and existing surface features.
 - 2. Locate exact location of existing utilities by hand methods of excavation, or by use of vacuum equipment.

- E. Maintain all existing utility mains and service lines in constant service during construction of the work when required.
- F. Where service disruptions are allowed, minimize the length of such disruptions by proper scheduling and diligent pursuit of the work.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 017700 Closeout Submittals
- B. Accurately record actual locations of utilities encountered.
- C. Provide As-Built drawing of new sewer facilities, including surveyed position and junctions with existing lines.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. PVC Pipe and Fittings, 3-inches in Diameter and Smaller: Schedule 40 PVC pipe, per ASTM D1785, 1120 high impact.
- B. PVC Pipe and Fittings, 4-inches through 15-inches in Diameter: Per ANSI/ASTM D3034, with gasketed joints. Minimum wall thickness shall conform to SDR 35. PVC compound additives and fillers, including but not limited to stabilizers, antioxidants, lubricants, colorants, etc., shall not exceed 10 parts by weight per 100 of PVC resin in the compound.
- C. Imported sand for PVC Pipe Bedding Envelope: Soil Type S5 imported sand material per Section 310513/2.1 E.
- D. Native soil for PVC Pipe Bedding Envelope: per Section 310513.
- E. Cleanout Boxes shall be precast reinforced concrete with cast iron lid marked for sewer service, Christy G5 or approved equal.
- F. Precast Reinforced Concrete Manhole Sections: Per ANSI/ASTM C478. Elliptical single line reinforcement is not allowed and as shown on detail drawing.
- G. Poured in Place Concrete: Per Section 033000.1.
- H. Reinforcement: Per Section 032000.1.
- I. Mortar: Composed of one part, by weight, portland cement (Type II low alkali per ASTM C150), 2 parts, by weight, sand, and water.
- J. Manhole Frames, Covers and Grates: Cast Iron per ASTM A48, Class 25.
- K. Soil Fill for Concrete Pipe Bedding Envelope: Backfill or Sandfill per Section 310513 and Section 312300.
- L. Concrete collar shall be constructed as per detailed drawing.

- M. Cleanout shall be constructed as per detail drawing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify site conditions.

3.2 PREPARATION

- A. Identify location of proposed sanitary sewer facilities to be constructed. Expose connection points to existing system and pothole other existing utilities which could conflict with proposed grade of sewer. Verify design grades versus actual elevation of existing utilities. Notify Construction Manager immediately of any conflicts.
- B. Locate, identify, field survey and protect existing above and below grade utilities from damage.
- C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.
- D. Protect existing structures and other improvements from damage from excavation equipment and vehicular traffic.
- E. Employ equipment and methods appropriate to the work site.
- F. Protect excavated areas from drainage inflow, and provide drainage of all excavated areas. Dewater existing pipeline systems as necessary to accomplish the work.
- G. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.
- H. Remove all interfering surface and subsurface improvements authorized for removal.

3.3 EXCAVATION

- A. Excavate soil required to locate existing utilities and install the work.
- B. Excavate trenches per Section 312300.
- C. Excavate trenches and pits to allow installation and construction of the sanitary sewer facilities to the alignment, grades, depths and cross-sections as indicated on the construction plans, or as directed by the Construction Manager. Adjust, as directed by the Construction Manager, to avoid existing intersecting utilities.
- D. Excavate trench to depth which is 4-inches below the outside bottom of the pipe barrel to be placed therein.

- E. Cut trenches just wide enough to allow the installation of the pipe and pipe bedding. Minimum trench width shall be that resulting from trench walls no closer than 4 inches outside the bell (or collar) of the pipe. Minimize trench width above the pipe.
- F. Provide protection to public per the City Standard Specifications.

3.4 INSTALLATION AND BEDDING OF SANITARY SEWER PIPE

- A. Install the pipe and fittings to the lines and grades shown on the construction plans, or to those directed by the Construction Manager.
- B. Install pipe and fittings in accordance with the manufacturer's recommendations, and these specifications.
- C. Unless otherwise approved by the Construction Manager, lay all pipe upgrade from structure to structure, with bell or socket ends of pipe upgrade.
- D. Excavate suitable bell (or socket) holes in the bedding material, so that the bells do not bear on the subgrade or bedding. Provide uniform bearing of pipe barrel on bedding material.
- E. Ensure that all joints are properly "homed" and are watertight.
- F. Place bedding material per Section 312300 and compact to a minimum of 92% relative compaction. Place and compact the soil material under, around and over the pipe, filling the trench cavity and extending from the bottom of the trench measured 6-inches below the outside bottom of the pipe barrel to a level 6-inches above the outside top of the pipe barrel.

3.5 INSTALLATION OF SANITARY SEWER STRUCTURES AND APPURTENANCES

- A. Install cleanouts at end of lines, at changes of direction greater than 45 degrees, and at spacing not greater than of 100 foot intervals. Locate cleanouts in accessible locations and bring flush to finished surface.
- B. Construct all sanitary sewer appurtenances, as shown on the construction plans.
- C. Connect sewer facilities to Prefabricated Building.

3.6 BACKFILLING TO FINISH GRADE, FINISH GRADING AND SURFACE RESTORATION

- A. Place and compact backfill per Section 312300.
- B. Conform finished surface to the lines, grades and cross-sections shown on the plans, or as otherwise directed by the Inspector.
- C. Fine grade all finished soil surfaces disturbed to the lines, grades and cross-sections shown on the plans. Rake and smooth all finished dirt surfaces.
- D. Rake and smooth all finished surfaces.
- E. Restore turfed areas disturbed by the work by per Construction Manager.

- F. Reconstruct any other surface improvements affected.

3.7 TOLERANCES

- A. Pipe laying tolerances:

1. Above grade: Not to exceed 1/4-inch above planned grade.
2. Below grade: Not to exceed 1/2-inch below planned grade.
3. Alignment: Not to exceed 2-inches from planned alignment, if gradual and regular over a distance of 20-feet.

- B. Structure finish grade tolerance: Within 1/4-inch of planned grade, but must match adjacent improvements.

PVC Pipe Deflection:

1. Up to and including 12-inch diameter: 5% maximum.
2. Over 12-inch and including 30-inch diameter: 4% maximum.
3. The maximum average inside diameter of the pipe shall be equal to the average outside diameter per applicable ASTM Standard minus two minimum wall thicknesses per applicable ASTM Standards. Manufacturing and other tolerances shall not be considered for determining maximum allowable deflections.

3.8 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of the City of Fresno Standard Specifications.
- B. Compaction testing of bedding and backfill will be performed in accordance with ANSI/ASTM D1557.
- C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest.
- D. Prior to final surface restoration, pull an Construction Manager approved steel mandrel through installed and backfilled PVC pipe by hand to prove deflection tolerance has not been exceeded. Remove any overdeflected pipe, and if the pipe is not damaged, reinstall it and retest it. If the pipe has been damaged, install new pipe and retest. Continue procedure until required tolerance is met. The mandrel shall:
 1. Be a rigid, nonadjustable, odd-numbering-leg (9 legs minimum) mandrel having an effective length not less than its nominal diameter.

2. Have a minimum diameter at any point along the full length of the nominal pipe as follows:

| Pipe Material | Nominal Size (Inches) | Minimum Mandrel Diameter (Inches) |
|--------------------------------|----------------------------------|--|
| PVC - ASTM D 3034 (SDR 35) | 6 | 5.619 |
| | 8 | 7.524 |
| | 10 | 9.405 |
| | 12 | 11.191 |
| | 15 | 13.849 |
| PVC - ASTM F 679 (T-1 WALL) | 18 | 16.924 |
| | 21 | 19.952 |
| | 24 | 22.446 |
| | 27 | 25.297 |
| | 30 | 28.502 |

3.9 STRUCTURE DETAILS

- A. Construct as shown on the plans.

END OF SECTION 333000

SECTION 334000 - STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Provide all materials, labor, equipment, and services necessary to furnish and install Storm Drainage System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded.

1.2 RELATED SECTIONS

- A. Division 31
- B. Section 033000.1– Site Cast-in-Place Concrete.

1.3 REFERENCES

- A. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
- B. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- C. ANSI/ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- D. California Test Method No. 216 (Dry Method).

1.4 DEFINITIONS

- A. Bedding: Fill placed under, around, beside and directly over pipe, prior to subsequent backfill operations.
- B. Utility: Any buried or above ground pipe, conduit, cable, associate device or appurtenances, or substructure pertaining thereto.

1.5 SUBMITTALS

- A. Submit under provisions of Section 013300 Submittal Procedures
- B. Certificates of compliance for material.
- C. Product Data: Provide data indicating pipe, accessories, and associated equipment to be furnished.
- D. Submit manufacturer's data and/or fabrication drawings for all pipes, and appurtenances installed under this Section. No items shall be incorporated into the work until submittals are approved by the Construction Manager.

1.6 COORDINATION

- A. Coordinate work with District personnel.
- B. Verify that the location of existing utilities have been indicated at work site by utility authorities and Campus personnel.
- C. Coordinate work with other project work.

1.7 EXISTING UTILITIES

- A. The Engineer has made a diligent attempt to indicate on the plans the location of all main and trunkline utility facilities which may affect the Work. In most cases, however, the only available information relative to the existing location of said

facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.

- B. Service laterals and appurtenances have also been shown where information was available as to their location. In most cases, however, the only available information relative to the existing location of said facilities was small scale undimensioned plats. The location of said facilities, therefore, shall be considered approximate only, until exposed by the Contractor.
- C. At new work location, expose by hand methods all existing utilities along the route of the new work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand methods to locate all existing facilities as indicated on the plans, and as indicated at the work site by District personnel.
- D. Maintain all existing utility mains and service lines in constant service during construction of the Work.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 017700.
- B. Accurately record actual locations of utilities encountered.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforced Concrete Pipe for pipe larger than fifteen (15) inches: ANSI/ASTM C76, Class 4, with rubber gasket joints per ANSI/ASTM C443.
- B. Storm drainage sewer pipeline shall be polyvinyl chloride (PVC) pipe for storm sewer conforming to ASTM designation 3034, SDR 35 for pipe fifteen (15) inches or less.
- C. Precast Reinforced Concrete Manhole Sections: Per ANSI/ASTM C478. Elliptical single line reinforcement is not allowed and as shown on detail drawing.
- D. Site Cast in Place Concrete: Per Section 033000.1.
- E. Reinforcement: Per Section 032000.1.
- F. Mortar: Composed of one part, by weight, portland cement (Type II low alkali per ASTM C150), 2 parts, by weight, sand, and water.
- G. Manhole Frames, Covers and Grates: Cast Iron per ASTM A48, Class 25.
- H. Storm drain inlets shall be Christy U-23 drain inlet with precast extension as required. Contractor shall also construct concrete bottom as shown on detailed drawings. Christy U-23 catch basin grates shall be U23-HT, ADA approved and for H20 loading.
- I. Soil Fill for Concrete Pipe Bedding Envelope: Backfill or Sandfill per Section 31 22 00 and Section 312300.
- J. Concrete collar shall be constructed as per detailed drawing.
- K. Cleanout shall be constructed as per detail drawing.

- L. Trench Drain with pedestrian friendly grate shall be constructed per detail and manufacturer's requirements. Manufactured by NDS, install EZ-Track Trench Drain System with ADA Compliant DS-670 grate (polyoelfen). (or approved equal)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify site conditions.

3.2 PREPARATION

- A. Identify location of proposed storm drainage facilities to be constructed. Expose connection points to existing system.
- B. Locate, identify, and protect existing above and below grade utilities from damage.
- C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.
- D. Protect existing structures and other improvements to remain from damage from excavation equipment and vehicular traffic.
- E. Employ equipment and methods appropriate to the work site.
- F. Protect excavated areas from drainage inflow and provide drainage to all excavated areas. Dewater existing drainage basins and existing drainage pipeline systems as necessary to accomplish the work.
- G. Comply with safety requirements as they pertain to excavations, per Section 312300.
- H. Remove all interfering surface and subsurface improvements authorized for removal.

3.3 EXCAVATION

- A. Excavate soil required to locate existing utilities and install the work.
- B. Excavate trenches and pits per Section 312300.
- C. Excavate trenches and pits to allow installation and construction of the storm drainage facilities to the alignment, grades, depths and cross-sections as indicated on the construction plans.
- D. Excavate trench to depth which is 4-inches below the outside bottom of the pipe barrel to be placed therein.
- E. Cut trenches just wide enough to allow the installation of the pipe and pipe bedding as indicated on the plans. Minimize trench width above the pipe.
- F. Provide protection to public per City of Fresno Standard Specifications

3.4 INSTALLATION AND BEDDING OF STORM DRAIN PIPE

- A. Install the pipe and fittings to the lines and grades shown on the construction plans.
- B. Install pipe and fittings in accordance with the manufacturer's recommendations, and these specifications.
- C. Unless otherwise approved by the Construction Manager, lay all pipe upgrade from structure to structure, with bell or socket ends of pipe upgrade.

- D. Excavate suitable bell (or socket) holes in the bedding material, so that the bells do not bear on the subgrade or bedding. Provide uniform bearing of pipe barrel on bedding material.
- E. Ensure that all joints are properly "homed" and are watertight.
- F. Bed concrete pipe in backfill or sandfill soil envelope, and compact to a minimum of 85% relative compaction. Place and compact the bedding material under, around and over the pipe, filling the trench cavity and extending from the bottom of the trench (4-inches below the outside bottom of the pipe barrel) to a level 12-inches above the outside top of the pipe barrel.

3.5 INSTALLATION OF STORM DRAINAGE STRUCTURES AND APPURTENANCES

- A. Install storm drainage structures as indicated on the construction plans, in accordance with the manufacturer's recommendations, and as specified herein.
- B. Construct poured-in-place concrete per Section 033000.1.
- C. Key top of poured-in-place concrete bases for structures to receive the tongue of precast riser sections.
- D. Joint precast manhole and structure riser sections with a minimum thickness of 1/2-inch of mortar to make a watertight joint. Neatly point the inside and outside of the joint. Set sections plumb.
- E. Construct cleanout, outfall structure per detail drawing.
- F. Construct Trench Drain per detail drawing and manufacturers requirements.

3.6 BACKFILLING TO FINISH GRADE AND FINISH GRADING

- A. Place and compact backfill per Section 312300.
- B. Conform finished surface to the lines, grades and cross-sections shown on the plans, or as otherwise directed by the Inspector.
- C. In areas to receive paving or a significant thickness of sealing material, temporarily set manhole frame and cover below finish grade, then return after final surfacing and/or pavement sealing and bring manhole frame and cover to final grade, as shown on the plans.
- D. Fine grade all finished soil surfaces disturbed to the lines, grades and cross-sections shown on the plans.
- E. Rake and smooth all finished dirt surfaces.

3.7 TOLERANCES

- A. Pipe laying tolerances:
 - 1. Above grade: Not to exceed 1/4-inch above planned grade.
 - 2. Below grade: Not to exceed 1/2-inch below planned grade.
 - 3. Alignment: Not to exceed 2-inches from planned alignment, if gradual and regular over a distance of 20-feet.
- B. Structure finish grade tolerance: Within 1/4-inch of planned grade but must match adjacent improvements.

3.8 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of the Construction Manager.

- B. Compaction testing of bedding and backfill will be performed in accordance with ASTM D 1557.
- C. If tests indicate work does not meet specified requirements, recompact, or remove and replace, and retest.

END OF SECTION

SECTION 334920 – STORM DRAINAGE DRYWELLS

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. General:
- B. Related Sections:
 - 1. Division 03 Section “Cast-In-Place Concrete” for cast-in-place concrete materials.
 - 2. Division 31 Section “Earth Moving” for trenching, excavating, and backfilling.

1.3 SUBMITTALS

- A. General: Submittals shall be in accordance with the Conditions of the Contract and Division 01 Specification Sections
- B. Product Certificates: For each type of material, from manufacturer.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect drywell components from dirt and damage

1.5 PROJECT CONDITIONS

- A. Call for underground utility locates and verify existing utility locations. Locate existing structures and piping to be closed and/or abandoned.
- B. Interruption of Existing Storm Drainage Service: Do not interrupt service to occupied facilities occupied permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1.6 SEQUENCING AND SCHEDULING

- A. Coordinate with building drainage systems (roof drains and storm drains).
- B. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Product material types are as indicated on the plans, unless otherwise noted.

2.2 DRYWELLS

- A. Drywells shall be in accordance with the Plans and these Specifications. Where not indicated, the following requirements shall apply.
- B. Drain Rock: Per Section 31 “Earth Moving”.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."
- B. Excavation shall allow for the placement of the specified volume of drain rock.

3.2 DRYWELL INSTALLATION

- A. Drywells shall be provided where indicated on the Plans and shall be installed in accordance with these Specifications. Where not indicated, the following requirements shall apply.
- B. Place cast in place concrete drywell components to sizes and shapes indicated.
- C. Place fabric, drain rock, and surface cap as indicated.
- D. Allow 72 hours for concrete to cure prior to placing backfill.
- E. Seal all pipe penetrations with non-shrink grout.

3.3 CONCRETE PLACEMENT

- A. Concrete shall be provided where indicated on the Plans and shall be installed in accordance with the Division 03 "Cast-In-Place Concrete" requirements.

3.4 CONNECTIONS

- A. Connections shall be provided where indicated on the Plans and shall be installed in accordance with these Specifications. Where not indicated, the following requirements shall apply
- B. Connect gravity-flow storm drainage piping to drywells per these specifications. Terminate piping where indicated.
- C. Make connections to existing piping and underground structures so finished work conforms as nearly as practical to requirements specified for new work, and as follows:
 - 1. Finished work shall conform as nearly as practical to requirements specified for new work.
 - 2. 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.

3.5 FIELD QUALITY CONTROL

- A. Prior to final grading, completed drywells shall be performance tested by filling with potable water as noted on the Plans.
 - 1. Performance tests shall be observed by a representative of the Engineer.
 - 2. Contractor shall notify Engineer no less than 48 hours prior to performance test.
- B. Contractor shall reconstruct defective drywell

END OF SECTION