MANGINI

MANGINI ASSOCIATES INC.
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Visalia, California 93291
(559) 627-0530

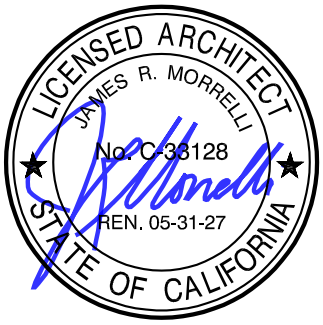
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DATE:	December 18, 2025
MAI NO.:	24042
OPSC APPL. NO.:	
DSA APPL. NO.:	02-123774
DSA FILE NO.:	10-126
PTN:	62414-206

PROJECT MANUAL FOR:

NEW TEMPERANCE ELEMENTARY SCHOOL

SANGER UNIFIED SCHOOL DISTRICT
SANGER, FRESNO COUNTY, CALIFORNIA



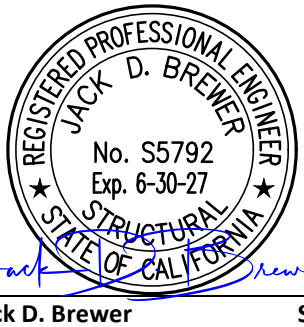
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IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 02-123774 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 09/22/26

SET NUMBER _____

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SECTION 00 3100 - AVAILABLE PROJECT INFORMATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section describes information available to the bidders and the use of such information.

1.2 SOILS INVESTIGATION REPORT

A. A soils investigation report has been prepared for the site by Salem Engineering Group, Inc., Report No. 1-220-0695, dated May 10, 2021 and recertified by Updated Addendum Letters dated May 20, 2025 and July 15, 2026.
   1. The soils investigation report may be inspected at the office of the Architect.
   2. Copies may be obtained upon request.

B. Use of Data:
   1. This report was obtained only for the Architect's guidance in the design of this Project and is not a part of the Contract Documents.
   2. The report is available to bidders, for information only, so that bidders have full disclosure of all information available to the Owner and Architect with respect to subsurface conditions at the Site. The report is not a warranty of subsurface conditions. Information is site specific as related to the boring locations noted.
   3. Bidders should visit the site and acquaint themselves with existing conditions.
   4. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but such investigations may be performed only under time schedules and arrangements approved in advance by the Architect and the Owner.

C. Cautions to Contractor:
   1. The report of subsurface conditions represents only those points where soil borings and other investigations were made in locations indicated in the report. The report does not reflect specific variations that may occur between these data collection points.
   2. Information indicated relative to soil moisture content and water table elevations represent conditions which existed at the time of the testing only and are subject to daily and/or seasonal variations. The Contractor shall not use this information as a fixed basis for bidding as the Contractor is expected to anticipate fluctuations in these areas and anticipate adjustments in his procedures to accommodate such.

D. A geotechnical engineer will be retained by the Owner to observe performance of work in connection with excavating, trenching, filling, backfilling, and grading, and to perform compaction and moisture tests.

END OF SECTION 00 3100

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SECTION 00 3110 - PRELIMINARY SCHEDULES

1. START OF WORK: Do not start work until receipt of written notice from Architect to proceed.

2. PROJECT SCHEDULE:

.1 Anticipated Award Date: December 9, 2026. This date is for preliminary scheduling only; Owner does not guarantee this date.

.2 Anticipated Notice to Proceed Date: January 1, 2027. This date is for preliminary scheduling only; Owner does not guarantee this date.

.3 Time for Completion: Complete all Work by June 1, 2028, commencing with the date established in the written notice from Owner to proceed.

3. OWNER OCCUPANCY

.1 The schedule is intended as a maximum time frame and should the Contractor be able to expedite the Work, the Owner and Architect will assist in advancing within the terms of the Contract.

END OF SECTION 00 3110

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SECTION 00 9110 - ADDENDA

1. In accordance with Section 4-338(a) of the California Administrative Code, 2025 Edition, changes or alterations of the approved plans and specifications prior to the letting of a construction contract for the Work shall be made by means of addenda, which shall be submitted to and approved by Division of the State Architect (DSA) prior to distribution to contractors.

2. Addenda shall be stamped and signed by the Architect or Engineer in general responsible charge of preparation of the plans and specifications, and by the Architect or Engineer delegated responsibility for the portion affected by the addenda.

3. Addenda issued during bidding, if any, will be inserted following this page in the Contract Documents sets issued for construction.

4. The provisions of all Addenda shall become part of the Contract Documents and Contractor shall be obligated to construct the Project in accordance with the Contract Documents as modified or supplemented by the addenda provisions.

END OF SECTION 00 9110

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For Procurement and Contract Requirements, refer to Request for Proposals and Qualifications Document, provided by Owner.

SECTION 01 1100 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY:

A. Related Sections: Close coordination between this Section, the General and Supplementary Conditions, and Divisions 1 through 33 is required.

B. Project Location: South Temperance Avenue, between E. California Ave and E. Church Ave, Fresno, CA, 93727

C. Project: The Project consists of the total construction of which the Work performed under the Contract Documents is a part and which may include construction by the Owner or by separate contractors, for:

NEW TEMPERANCE ELEMENTARY SCHOOL

D. Work: The Work of the Project consists of all labor, material, equipment, and services to perform all selective demolition and construction required by the Contract Documents, for the construction of 1 New Elementary School, including but not limited to 7 single-story wood frame buildings with a total floor area of 60,120 square feet, 1 CMU central plant building with a total floor area of 1,020 square feet, and related on-site and off-site improvements.

E. Applicable Codes: All work shall be performed in accordance with the plans, specifications and the following regulations:
1. 2022 Building Standards Administrative Code, Part 1, Title 24 CCR.
2. 2022 California Building Code (CBC), Part 2, Title 24 CCR.
3. 2022 California Electrical Code (CEC), Part 3, Title 24 CCR.
4. 2022 California Mechanical Code (CMC) Part 4, Title 24 CCR.
5. 2022 California Plumbing Code (CPC), Part 5, Title 24 CCR.
6. 2022 California Energy Code (CEC), Part 6, Title 24 CCR.
7. 2022 California Fire Code, Part 9, Title 24 CCR.
8. 2022 California Green Building Standards Code (CALGreen), Part 11, Title 24 CCR.
9. 2022 California Referenced Standards, Part 12, Title 24 CCR.
10. Title 19 CCR, Public Safety, State Fire Marshal Regulations.
11. 2022 NFPA 72 National Fire Alarm Code, as amended.
12. 2022 NFPA 80 Fire Door and Other Opening Protectives.
13. 2022 NFPA 13 Automatic Sprinkler Systems, as amended.
14. 2022 NFPA 17a Wet Chemical Systems.
15. 2022 NFPA 14 Standpipe Systems.
16. 2022 NFPA 20 Stationary Pumps for Fire Protection Systems.
17. 2022 NFPA 24 Private Fire Mains and Their Appurtenances, as amended.
18. 2018 NFPA 2001 Clean Agent Fire Extinguishing Systems, as amended.
19. 2017 ASME A18.1 Safety Standard for Platform Lifts and Stairway Chairlifts.

F. Conflicts in the Drawings and Specifications:
1. When conflicts are noticed prior to bidding, the bidder shall notify the architect immediately in order that an addendum can be issued to all bidders prior to bidding. When the discrepancy is noticed after the bid, the architect shall be notified and will review the discrepancy and interpret the intent. For the purpose of bidding and interpreting, **the most restrictive and potentially most expensive condition may prevail.**
2. In the case of ambiguity, conflict, or lack of information, the Architect shall respond with reasonable promptness and provide additional instructions, by means of drawings and/or written instructions, as may be otherwise necessary for proper execution of the work. All such drawings and instructions shall be

consistent with the contract documents, true developments thereof, and reasonably inferable therefrom.

1.2 DIVISION OF THE STATE ARCHITECT REQUIREMENTS

A. Addenda: Changes or alterations of approved plans or specifications that affect structural, fire/life safety, or accessibility portions of the Project prior to letting a construction contract shall be made by means of addenda submitted to and approved by DSA in accordance with Section 4-338, California Administrative Code, Title 24, Part 1, California Code of Regulations.

B. Changes: Changes or alterations of approved plans or specifications that affect structural, fire/life safety, or accessibility portions of the Project after a contract for the work has been let shall be made by means of Construction Change Documents submitted to and approved by DSA in accordance with Section 4-338, California Administrative Code, Title 24, Part 1, California Code of Regulations.
   1. Refer to Section 01 2600 for modification procedures.

1.3 CONTRACTS

A. All work of this project will be let as a guaranteed maximum cost under a lease-leaseback contract.

1.4 FEES AND PERMITS

A. The Owner will be responsible to obtain and pay for the following:
   1. DSA approval and field inspection fee.
   2. Storm Water Prevention Pollution Plan filing fee.
   3. Dust Control Plan filing fee.
   4. Indirect Source Review filing fee.
   5. Service connection fees to gas, permanent telephone, and permanent power utilities.
   6. City/County engineering review and inspection fee for work performed in the public right-of-way.
   7. Transportation mitigation, water system, wastewater system, storm water system, fire protection, and police protection impact fees.

B. The Contractor shall be responsible to obtain and pay for the following:
   1. Permits and licenses required for work performed in the public right-of-way.
   2. Permits, licenses, and inspection fees required for execution and completion of the Work which are not the responsibility of the Owner.
   3. Permits and inspection fees required for construction or abandonment of wells.

C. The Contractor shall be responsible for requesting all inspections required by the governing jurisdictions.

1.5 FUTURE WORK

A. Route all underground utilities a minimum of 10'-0" away from all building footprints identified as future construction.

B. Construct building pads for future buildings as indicated, grading top of pad to provide for drainage.

1.6 WORK SEQUENCE

A. Refer to Section 00 3100 for preliminary schedule requirements.

B. Construct the Work within the following constraints:

   1. Fire Department Requirements: Provide fire hydrants in working order and approved by the local fire

agency having jurisdiction and provide all-weather fire access roads prior to delivering combustible materials to the site.

2. Finish Flooring Installation: Complete enclosure of interior spaces, make HVAC system operational, and bring interior spaces to design temperature and humidity 48 hours prior to vapor emission control treatment pre-testing as specified in Section 09 6110.
3. Building Flush Out: Provide flush out of building with 100% outside air for 14 calendar days as required by Section 23 0001.
4. Planting Schedule: Coordinate with schedules on Landscape Specifications 32 8400.
    a. Coordinate all site improvements of the playfield including site fencing, concrete, storm drain, sprinkler irrigation, electrical, water compaction, soil preparations, site grading, finish grading, pressure testing, water testing, tree planting, turf grass seeding, and all necessary work to meet the planting deadline.
    b. Contractor may be required to furnish, install, and maintain a temporary power supply for the irrigation controllers and booster pump if the proposed site power is not available in order to meet the planting deadline.
    c. Contractor is solely responsible for all costs associated with providing the temporary power.

1.7 CONTRACTOR'S USE OF PREMISES

A. Limit use of the site to construction activities in the areas indicated.

B. Confine operations to areas within the Contract Limits indicated. Portions of the site beyond areas in which construction operations are indicated shall not be disturbed.

C. Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

D. Keep driveways and entrances serving the premises clear and available at to the Owner, the Owner's employees, and the public at all times.

E. Keep bus lanes and drop-off zones clear and available to the Owner at all times.

F. Use of existing toilets within the existing buildings, by the Contractor, shall not be permitted.

G. Store and stockpile materials on the property, excluding public rights-of-way.

1.8 OWNER OCCUPANCY

A. Owner intends to occupy the Project by the date stated in the Agreement as the Contract Completion Date.

1.9 CONSTRUCTION ACTIVITIES IN THE PUBLIC RIGHT-OF-WAY

A. Do not obstruct roadways, sidewalks, or other public ways without permit.

B. Traffic shall be maintained on public streets and roads at all times. Connections of new underground utilities to existing underground utilities shall be conducted in such a manner as to maintain at least one full lane of traffic at all times.

C. The Contractor shall provide barricades, traffic control devices, and flagmen as needed or as directed by the governing jurisdiction, to control vehicular and pedestrian traffic.

D. The Contractor shall provide periodic clean-up of deposited dirt, debris, and mud on all streets and roads in a manner acceptable to the governing jurisdiction.

1.10 WORK BY OWNER

A. Items noted as NIC (Not In Contract) will be furnished and installed by the Owner.

B. The Owner will furnish and install the following work:
   1. Classroom and miscellaneous equipment and furnishings indicated as NIC.

1.11 OWNER FURNISHED PRODUCTS

A. Owner will furnish certain products for installation by the Contractor as indicated on the Drawings. Refer to Drawings for additional information.

B. The Owner will be responsible for shop drawings, delivery to the site, damaged items, and warranties. The Contractor shall be responsible for receipt of products at the site, protection of delivered products, and installation of the products.

C. Material List: Any material or accessories required for the installation in excess of the Owner furnished material shall be supplied by the Contractor. It is the Contractor's responsibility to determine the precise amount of material required for the completion of the Work and to provide excess material, as needed.

END OF SECTION 01 1100

SECTION 01 2100 - CASH ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. To provide adequate budget and bonding to cover items not precisely determined by the Owner prior to bidding, allow within the proposed Contract Sum the amounts described in this Section.

B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Other provisions concerning Cash Allowances are stated in Paragraph 3.8 of the General Conditions.
3. Other provisions concerning Cash Allowances also may be stated in other Sections of these Specifications.

1.2 CASH ALLOWANCE PROVISIONS

A. Costs Included in Cash Allowances: As defined in the General and Supplementary Conditions.

B. Architect Responsibilities: Architect shall meet with the Owner, Contractor and product manufacturer to determine the products for use.

C. Contractor Responsibilities: Cooperate with Owner's testing laboratory to obtain timely information relative to substrate conditions and actual cost of products selected.

D. Differences between the allowance amount and the actual cost of the Work will be adjusted by Change Order.

1.3 ALLOWANCES SCHEDULE

A. Offsite Electrical Utility Work: Include the sum of **$750,000.00** for work required by the power utility, according to their Rule 16 or Rule 15 engineering, in addition to that indicated in the Contract Documents.

B. General Contingency: Include the sum of **$2,125,000.00** for general contingency, in addition to that indicated in the Contract Documents.

END OF SECTION 01 2100

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section describes procedures for securing approval of proposed substitutions.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Make submittals in accordance with pertinent provisions of Section 01 3300.

1.2 SUBSTITUTIONS

A. Substitutions: Contractors, subcontractors and/or material suppliers shall comply with the requirements set forth in this Section. All requests for material substitutions shall be submitted with all required substantiating data, comparisons to the material specified, including samples and colors as needed to determine their acceptance. Failure to provide the required documentation is justification for rejection.
1. Prior to Bid: Substitution Requests shall be submitted a minimum of 10 days prior to the bid (if material is to be included on the final addendum). Substitutions may be submitted by general contractor or subcontractor bidders directly to the Architect.
2. After Award of Contract. Substitution Requests may be submitted not more than 35 days after the award of the contract. Substitution requests shall only be submitted by the General Contractor.
3. Substitution Requests received greater than 35 days after the award shall be rejected.

B. Required Substitution Submittal Requirements:
1. Submit required substitution information with a completed “Substitution Request Form” found at the end of this Section.
2. Manufacturer's descriptive literature and product specifications for each product, with the proposed products clearly identified.
3. Comparative specification data between the specified item and the proposed substitution, showing compliance with the specified requirements.
4. Test reports indicating compliance with ASTM standards and ICC ES approvals where compliance with such standards is required by the Contract Documents or where compliance is claimed by the Contractor requesting substitution.
5. Samples of actual material and color, where applicable.
6. **Submittal without this information will automatically be rejected.**

C. Approval of Substitutions:
1. Where the phrase "or equal," or "or equal as approved by the Architect," occurs in the Contract Documents, do not assume that the materials, equipment, or methods will be approved as equal unless the item has been specifically so approved for this Work by the Architect.
2. The burden of proof as to the equivalency of any material, process, or product shall rest with the Contractor. Any or all of the following will be used by the Architect to determine if a proposed substitution is equivalent to the specified products or materials:
a. Code and legislative compliance.
b. Functional performance and characteristics.
c. Industry standard compliance.
d. Composition of materials.
e. Cost.

f. Aesthetic characteristics.
g. Environmental characteristics.
h. Manufacturer characteristics.
i. Installation characteristics.
j. Maintenance requirements.
k. Warranty characteristics.

3. **Approvals shall be at the sole discretion of the Architect and the decision of the Architect shall be final and binding.**
4. The provisions allowing submission of substitutions shall not in any way authorize an extension of time for performance of the Work.

D. Substitution of any material, system, or product that would normally be reviewed by DSA (Structural Safety, Fire/Life Safety, Access Compliance, or Energy) shall be submitted to and approved by DSA prior to fabrication or use. Such substitutions shall be considered Construction Change Document in accordance with Section 01 2600.

1.3 DELAYS

A. Delays in construction arising by virtue of the non-availability of a specified material due to late approval and/or ordering of materials will not be considered as justifying an extension of the agreed Time of Completion, or reason for change.

B. All additional time required by the Architect or his consultants in dealing with such delay will be charged to the Contractor at the rates described in section 01 7700 1.4.B.2.

C. Equal or better material replacements caused by delay in approvals and/or ordering may cost more than the original material specified. Increased costs shall be absorbed by the Contractor and not the Owner.

END OF SECTION 01 2500

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SUBSTITUTION REQUEST FORM

PROJECT: _____

SPECFICIATION SECTION: _____ **ARTICLE/PARAGRAPH:** _____

SPECIFIED SECTION: _____

PROPOSE SUBSTITUTION: _____

Attach complete technical data including laboratory tests and code approvals, detailed drawings, and other data indicating compliance with the requirements of the Contract Documents. Clearly identify products being proposed for substitution. Include complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proper installation.

FILL IN BLANKS BELOW:

A. Does the substitution affect dimensions on Drawings? ☐Yes ☐No

B. Will the undersigned pay for changes to the building design, including building design, engineering and detailing costs caused by the requested substitution? **(Negative response may be cause for rejection)**
☐Yes ☐No Explain: _____

C. What affect does substitution have on other trades? _____

D. Differences between proposed substitution and specified item? _____

E. Manufacturer's guarantee of the proposed and specified items are: ☐Same ☐Different
Explain: _____

F. Manufacturer will provide colors that match color selection in finish schedule: ☐Yes ☐No

The Undersigned hereby certifies that the function, appearance, and quality are equivalent to or superior to the specified item. The undersigned agrees to waive all claims for additional costs related to accepted substitution, including costs associated with changes to building design, engineering, or details, which may subsequently become apparent.

Submitted by: _____

Signature: _____ Date: _____

Firm: _____

Phone: _____ Address: _____

Fax: _____

ARCHITECT'S REVIEW AND ACTION

☐Accepted – Make submittals in accordance with Section 01 2500.
☐Accepted as noted – Make submittals in accordance with Section 01 2500.
☐Rejected – Use specified materials.
☐Received too late – Use specified materials.

By: _____ **Date:** _____

MANGINI ASSOCIATES INC.

Remarks: _____

SECTION 01 2600 - CONTRACT MODIFICATION PROCEDURES AND FORMS (DSA)

PART 1 - GENERAL

1.1 SUMMARY:

A. This section includes procedural requirements for consideration and execution of modifications to and interpretations of the Contract Documents. This section is intended to supplement requirements set forth in the Agreement and the General and Supplementary Conditions.

B. Section includes:
1. Documentation of changes in Contract Sum and Contract Time.
2. Interpretation and clarification procedures.
3. Change procedures.
4. Correlation of Contractor submittals based on changes.

C. Related Sections:
1. Close coordination between this Section, the General and Supplementary Conditions, and Divisions 1 through 33 is required.
2. Section 00 5210: Agreement, Contract Sum, retainage, payment period, values of unit prices.
3. Section 00 7210: Requirements for progress payments, final payment, changes in the Work.
4. Section 00 7310: Percentage allowances for Contractor's overhead and profit.
5. Section 01 2100: Payment procedures relating to allowances.

1.2 DIVISION OF THE STATE ARCHITECT REQUIREMENTS

A. In addition to the modification requirements of this section, the Agreement, and the General and Supplementary Conditions, the Division of the State Architect (DSA) requires that all changes to the approved construction documents that affect structural, accessibility, or fire/life safety portions of the Project be submitted to and approved by DSA in accordance with the procedure set forth in the current edition of DSA Interpretive Regulation IR A-6.

B. Definitions:
1. **Approved Construction Documents:** The approved construction documents are the drawings, specifications, addenda, deferred approvals, changes and bulletins approved by the governing code jurisdiction.
2. **Change:** A change is a revision, modification, deletion, addition, or substitution to the approved Construction Documents.
3. **Change Order:** A document defining and memorializing construction changes that result in changes to the Construction Contract, usually changing Contract Sum or Contract Time.
4. **Clarification:** A clarification is a statement that clarifies (but does not change) the requirements of the approved Construction Documents.
5. **Construction Change Directive:** A document defining and memorializing construction changes that result in changes to the Construction Contract, usually changing Contract Sum or Contract Time, specifically when the Owner and Contractor do not agree to the terms surrounding the changed work.
6. **Construction Change Documents (CCD):** The documentation of construction changes for DSA purposes, using DSA Form-140, prepared and submitted by the Architect.
7. **Contract:** A written agreement for construction, alteration, reconstruction, repair, or other construction activities.
8. **DSA:** The Division of the State Architect (DSA) is the Authority Having Jurisdiction over Project for code compliance.
9. **Interpretation:** An interpretation is a statement that interprets (but does not change) the requirements of the approved Construction Documents.

C. **DSA Changes:** In accordance with the current edition of DSA Interpretation of Regulation IR A-6, changes to the approved construction documents that affect structural, accessibility, or fire/life safety portions of the Project made after a contract for the Work has been let shall be made by means of a Construction Change Document submitted and approved by DSA prior to commencement of the Work shown thereon.

D. **Non-DSA Changes:** In accordance with the current edition of DSA Interpretation of Regulation IR A-6, changes to the approved construction documents that do not affect structural, accessibility, or fire/life safety portions of the Project are not required to be submitted to or approved by DSA.

E. **Change Orders:** DSA does not review change orders.

1.3 MODIFICATION PROCEDURES

A. Definitions:
   1. **Bulletin:** A bulletin is a document produced by the Architect to memorialize all changes, clarifications and interpretations to the approved Construction Documents. A bulletin may or may not change the Contract Sum or the Contract Time.
      a. For the purpose of changes requiring DSA approval, the Architect's Bulletin number will be the same as the DSA CCD number.
   2. **Bulletin Log:** The Bulletin Log is an organized method of numbering, logging, cost accounting, and tracking the status of each bulletin issued.

B. For minor changes not involving an adjustment to the Contract Sum or Contract, the Architect will issue a Bulletin which provides supplementary instructions and information, including a detailed description of the change with supplementary or revised drawings and specifications.
   1. Proceeding with the changes described in the Bulletin indicates the Contractor's acknowledgment that there will be no change in Contract Sum or Contract Time.
   2. In the event the Contractor believes that such Bulletin constitutes a change to the adjustment to the Contract Sum or Contract Time, the Contractor shall immediately give written notice to the Architect within 10 calendar days of receipt of the Bulletin stating that the Contractor considers the Bulletin to be a Change Order. Failure to give such written notice shall waive the Contractor’s right to seek additional time or cost.

C. For changes involving adjustment to the Contract Sum or Contract Time, Architect will issue a Bulletin which provides a detailed description of the proposed change with supplementary or revised drawings and specifications.
   1. Contractor shall prepare and submit a fixed price quotation in the form of a Change Order Request (COR) within 14 calendar days.
   2. The Owner shall provide written acceptance of the Contractor's COR prior to the Contractor commencing work described in the COR.

D. The Contractor may propose a change by submitting a Change Order Request (COR) to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6200.

E. Execution of Change Orders: Architect will issue Change Orders on the form attached at the end of this Section for signatures of parties as provided in the Conditions of the Contract.

F. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

G. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

H. Promptly enter changes in Project Record Documents.

1.4 CONTRACT INTERPRETATION AND CLARIFICATION PROCEDURES

A. **Request for Information (RFI):** A written request from the Contractor to the Architect, seeking an interpretation or a clarification of some requirement of the Contract Documents. The Contractor shall clearly and concisely set forth the issue for which it seeks clarification or interpretation and why a response is needed from the Architect. The Contractor shall, in the written request, set forth its interpretation or understanding of the contract's requirements along with reasons why it has reached such an understanding.
   1. The Architect will review all RFI to determine whether they are RFI within the meaning of this term. Project communications; substitution submittals; product data, shop drawings, or samples submittals, or construction schedule submittals shall not transmitted by RFI. Project communications shall not be considered RFI.
   2. Responses to RFI shall be issued within 10 calendar days of receipt of the request from the Contractor unless the Architect determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Architect, the Architect will, within 10 calendar days of receipt of the request, notify the Contractor of the anticipated response time. If the Contractor submits a Request for Information on an activity with 10 calendar days or less of float on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Architect to respond to the request provided that the Architect responds within the 10 calendar days set forth above.
   3. In the event the Contractor believes that a response to a Request for Information will cause a change to the requirements of the Contract Documents, the Contractor shall immediately give written notice to the Architect within 10 calendar days of receipt of the request the Architect stating that the Contractor considers the response to be a Change Order. Failure to give such written notice shall waive the Contractor's right to seek additional time or cost under the Changes article of the General Conditions.
   4. Failure on the part of the Contractor to provide timely Requests for Information does not constitute a crisis solution from the Architect.
   5. Requests for Information that affect structural, accessibility, or fire/life safety portions of the Project made after a contract for the Work has been let shall be submitted to and approved by DSA as a Construction Change Document prior to commencement of the Work shown thereon.

END OF SECTION 01 2600

MANGINI

MANGINI ASSOCIATES INC.
4320 West Mineral King Avenue
Visalia, California 93291
(559) 627-0530

www.mangini.us

REQUEST FOR INFORMATION RFI NO.

TO: **Mangini Associates Inc.**
Attn:

DATE:
ARCHITECT'S RFI NO.:
PROJECT NO.:
DSA APPL. NO.:

PROJECT:

Subject: _____
Plan/Spec. Ref: _____
Question: _____
Suggestion: _____
Attachments: _____
_____

Contractor's Contract Status:

- ☐ No change in contract time of sum required
- ☐ Change in contract time may be required
- ☐ Change in contract sum may be required

The undersigned certifies that the Contractor has thoroughly reviewed all Contract Documents and determines that the information requested is not contained in the Contract Documents.

By: _____ **Company:** _____ **Title:** _____
Phone: _____ **Fax:** _____ **Email:** _____

Response:

By: _____ **Date:** _____
MANGINI ASSOCIATES INC.

CC: _____

SECTION 01 2920 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Schedule:
1. In coordination with the CPM schedule activities specified in Section 01 3220, provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the Work, as specified herein and in other provisions of the Contract Documents.

B. Related Sections:
1. Section 00 5240: Form of Agreement related to Sublease Payments.
2. Section 00 5240: General Conditions related to payment procedures.
3. Section 01 3220: CPM construction schedules, schedule updates, and project control reports.

1.2 SCHEDULE OF VALUES

A. Submittal: One week prior to first sublease payment, submit proposed Schedule of Values to Architect.
1. Meet with Architect and determine additional data, if any, required to be submitted.

B. Activity Dollar Value: Assign a dollar value to each activity which includes overhead and profit.

C. Construction Activity Breakdown:
1. Limit activities to a single floor level.
2. Separate vertical activities from horizontal activities.
3. Separate site work into quadrants.
4. Separate on-site work from off-site work.
   a. Additionally, separate utility work from point of connection up to and including any metering devices from the balance of “on-site” utility work.
5. For plumbing, mechanical, and electrical work, separate activities into underground, rough-in, and finish activities.
6. Separate costs (cabling, devices, installation, programming, testing) for each of the following systems from the other power and lighting electrical costs:
   a. Fire alarm.
   b. Data
   c. Telephone.
   d. Intercom / clock.
   e. Intrusion alarm.
7. For concrete work, separate activities into footings, exterior walks, interior slabs, curbs/mowstrips.

D. Division 1 Activities: At a minimum, break down Division 1 costs into the following categories:
1. Mobilization.
2. Submittals.
3. Scheduling and schedule updates.
4. Permits and fees.
5. Surveying.
6. Supervision/administration.
7. Bonds and insurance.
8. Temporary offices and utilities.
9. Temporary fencing and storage.
10. Demobilization.

1.3 QUALITY ASSURANCE

A. Assure arithmetical accuracy of the sums described.

B. When so requested by the Architect, provide copies of the subcontracts or other data acceptable to the Architect, substantiating the sums described.

1.4 APPLICATIONS FOR PAYMENT

A. **Invoice for Sublease Payment:** Contractor shall submit invoices in accordance with the Schedule of Sublease Payments.

B. **Procedure:** Submit in accordance with General Conditions Article 9.3.

END OF SECTION 01 2920

SECTION 01 3110 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. To enable orderly review during progress of the Work, and to provide for systematic discussion of problems, the Architect will conduct project meetings throughout the construction period. The Contractor's relations with his subcontractors and materials suppliers and discussions relative thereto, are the Contractor's responsibility and normally are not part of project meetings content.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 SUBMITTALS

A. Agenda Items: To the maximum extent practicable, advise the Architect at least 48 hours in advance of project meetings regarding items to be added to the agenda.

B. Minutes: The Architect will compile minutes of each project meeting, and will furnish one copy to the Contractor and to the Owner. Recipients of copies may make and distribute such other copies as they wish.

1.3 QUALITY ASSURANCE

A. For those persons designated by the Contractor to attend and participate in project meetings, provide required authority to commit the Contractor to solutions agreed upon in the project meetings.

1.4 MEETING SCHEDULE

A. Except as noted below for Preconstruction Meeting, project meetings will be held weekly.

B. Coordinate as necessary to establish mutually acceptable schedule for meetings.

1.5 MEETING LOCATION

A. The Architect will establish meeting location. To the maximum extent practicable, meetings will be held at the job site.

1.6 PRECONSTRUCTION MEETING

A. Preconstruction Meeting will be scheduled to be held within 15 working days after the Owner has issued the Notice to Proceed.
   1. Mandatory attendance by authorized representatives of the Contractor and major subcontractors, including but not limited to:
      a. Earthwork.
      b. Concrete.
      c. Masonry.
      d. Rough carpentry.
      e. Roofing.
      f. Plumbing/mechanical.
      g. Electrical.
      h. Data

2. The Architect will advise other interested parties, including the Owner, and request their attendance.

B. Minimum Agenda: Data will be distributed and discussed on at least the following items:
1. Organizational arrangement of Contractor's forces and personnel, and those of subcontractors, materials suppliers, and Architect.
2. Channels and procedures for communications.
3. Construction schedule, including sequence of critical work.
4. Contract Documents, including distribution of required copies of original Documents and revisions.
5. Processing of Shop Drawings and other data submitted to the Architect for review.
6. Processing of Requests for Information, Proposal Requests, Change Orders and Payment Requests.
7. Rules and regulations governing performance of the Work; and
8. Procedures for safety and first aid, security, quality control, housekeeping, and related matters.

1.7 PROJECT MEETINGS

A. Attendance:
1. To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work.
2. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspect of the Work is involved.

B. Minimum Agenda:
1. Review, revise as necessary, and approve minutes of previous meetings.
2. Review progress of the Work since last meeting, including status of submittals for approval.
3. Identify problems which impede planned progress.
4. Develop corrective measures and procedures to regain planned schedule.
5. Complete other current business.
6. Verify that Record Drawings are current and accurate.

C. Revisions to Minutes:
1. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.
2. Persons challenging published minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.
3. Challenge to minutes shall be settled as priority portions of "old business" at the next regularly scheduled meeting.

END OF SECTION 01 3110

SECTION 01 3220 - CONSTRUCTION PROGRESS SCHEDULES (CPM)

PART 1 - GENERAL

1.1 SUMMARY

A. Prepare and maintain a construction schedule using the Critical Path Method (CPM), and consisting of the network diagram, mathematical analysis, and associated reports.
   1. Submission of progress and revision data will be used to measure work progress, aid in evaluating time extensions.
   2. All schedule activities shall be tied to schedule of values activities for progress payments.

B. Related Sections:
   1. Section 00 3100: Preliminary Schedules.
   2. Section 01 1100: Work sequences and constraints, Owner occupancy, and Owner furnished items.
   3. Section 01 3300: Requirements for shop drawings, product data, and samples.
   4. Section 01 2920: Schedule of values and payments.
   5. Section 01 7700: Project completion and closeout requirements.

1.2 SUBMITTALS

A. Schedule Development and Update Submittals: Submit 4 color copies and one electronic copy of network diagram and 4 copies of required schedule reports required by Article 1.11 with each of the following submittals:
   1. Preliminary network diagram.
   2. Complete network diagram.
   3. Construction schedule (baseline schedule).

B. Project Control Reports: Submit 4 color copies of network diagram and 4 copies of required schedule reports and narrative report required by Article 1.15.A.5 with each application for payment.

C. Two-Week Rolling Schedules: Submit copies to each participant at each weekly progress meeting.

1.3 SCHEDULE DEVELOPMENT

A. Preliminary Network Analysis: Within 35 calendar days of the date of Owner's Notice of Award and prior to the first application for payment, submit proposed Preliminary Network Diagram for review, defining planned operations for the first 90 days of Work, with a general approach for remainder of Work.
   1. Limit level of detail to minimum of 50 activities and maximum of 200 activities.
   2. Include submittals required within the first 90 days, and milestone dates.
   3. Submit required schedule reports listed in Article 1.15.
   4. Submittal and acceptance of the Preliminary Network Analysis is condition precedent to the processing of the Contractor’s applications for payment.
   5. The activities and relationships of the Preliminary Network Analysis shall coincide with and mesh with the activities of the Complete Network Analysis.

B. Complete Network Analysis: Within 28 days after Architect’s review and acceptance of the Preliminary Network Analysis and prior to the second application for payment, submit Complete Network Analysis for review, including:
   1. Network diagram defining planned operations for the entire project.
   2. Required schedule reports listed in Article 1.15.
   3. Listing of input data for each activity which generates reports.

C. Construction Schedule: Within 14 days after Architect's review of Complete Network Analysis, submit the Construction Schedule consisting of:
   1. The complete network diagram defining planned operations for the entire project.
   2. Required schedule reports listed in Article 1.15.
   3. Bar chart as specified in Article 1.16.

D. Baseline Schedule: The Construction Schedule, when accepted by the Owner and Architect for compliance with the Contract Documents, shall establish the Baseline Schedule.

1.4 SCHEDULE UPDATES

A. Update schedule monthly as part of the Project Control Report specified in this Section.

B. Update schedule as follows:
   1. Enter actual start and finish dates for activities started and completed during the previous period.
   2. Show estimated duration (in workdays) to complete each activity (remaining duration) started but not completed.
   3. Graphically indicate progress of each active activity and the estimated remaining duration.
   4. Record and report logic changes.

C. Progress Override: Actual progress and changes in logic directed in the field shall override retained logic in the schedule in all updates.

D. Default Progress Data Disallowed:
   1. Actual start and finish dates shall not be automatically updated by default mechanisms that may be included in the scheduling software.
   2. Work activities shall be updated by actual work progression rather than being cash flow driven. The updating of the percent complete and the remaining duration shall be independent functions; program features that calculate one of these parameters from the other shall be disabled.

E. Other Required Updates: In addition to updates required for the Project Control Reports, provide a complete schedule submittal whenever the Contractor's planned sequence of construction is changed, when approved change orders impact critical path activities, or when time extension is approved by change order.

1.5 RESPONSIBILITY FOR THE SCHEDULE

A. Responsibility for construction planning and the effective and efficient implementation of such to meet the Contract Completion Date and any required milestones is the sole responsibility of the Contractor.

B. Review of the schedule and subsequent revisions by the Owner or the Architect shall be limited to review for compliance with the requirements of the Contract Documents; review shall not imply agreement of the Owner or Architect to the Contractor's planned procedures, coordination, scheduling, etc., as being appropriate or reasonable. Comments offered by the Owner or Architect relating to schedule logic or sequence which are the Contractor's responsibility are offered as a courtesy and are not conditions of acceptance.

C. Non-Waiver:
   1. If the accepted schedule and subsequent revisions do not include contractually required constraints, review and/or acceptance of the schedule and subsequent revisions by the Owner or the Architect shall not waive such requirements.

2. Review of the schedule and subsequent revisions by the Owner or the Architect shall not constitute a waiver of any contract requirement.
3. Contract requirements shall take precedence in the event of conflicts between the accepted schedule and contract requirements.

1.6 CONTRACT MODIFICATIONS

A. When a contract modification is required, submit proposed schedule revisions reflecting the proposed change impact.
   1. Submit three copies of the float report, schedule change report and a time impact analysis, with the cost proposal.
   2. Only approved contract modifications will be added into the subsequent monthly updates.
   3. Changes shall be added to the schedule by adding new activities and relationships.

B. Time Impact Analysis: Time impact analysis shall be provided as support of a time extension, claim or request for equitable adjustment by the Contractor.
   1. Submit a time impact analysis illustrating the influence of each change or delay on the Contract Completion Date or milestones. The current monthly updated schedule accepted by the Architect shall be used to display the impacts of the change. No other non-approved modifications shall be incorporated into the schedule being used to justify the change impact.
   2. Each time impact analysis shall include a fragmentary network demonstrating how the Contractor proposes to incorporate the impact into the schedule. The fragmentary network shall identify the predecessors to the new activities and demonstrate the impact to successor activities.
   3. Include a narrative report describing the effects of new activities and relationships to interim and Contract Completion Dates.
   4. Include written certification signed by the major subcontractors that they have reviewed and accepted proposed schedule revisions.

C. Determination of contract time extension shall be based on the schedule updates in effect for the time period in question, and other factual information. Actual delays found to be caused by the Contractor's own actions, which result in the extension of the schedule, will not be cause for time extension to the Contract Completion Date.

1.7 TIME EXTENSIONS

A. Extension of time for performance will be granted only to the extent that equitable time adjustments for the activity or activities affected exceed the total float or slack along the network paths involved at the time the change was approved.

B. The Contractor acknowledges and agrees that delays in activities which, according to the schedule, does not in fact actually affect any milestone completion or the Contract Completion Date shown on the schedule at the time of delay, will not be a basis for a time extension.

1.8 SCHEDULE RECOVERY

A. The Contractor shall take action to put the Project back on schedule, at no additional cost to the Owner, when it becomes apparent from the current schedule that, through no fault of the Owner:
   1. Any non-critical activity is delayed beyond its total float time and changes the critical path.
   2. Any milestone required by the Contract Documents may not be met.
   3. Any schedule update reveals that the Work will complete later than the Contract Completion Date.

B. Action by the Contractor to put the Work back on schedule may include any or all of the following:

1. Increase construction manpower;
2. Increase the number of working hours per shift, shifts per working day, working days per week, or the amount of construction equipment, or any combination of the foregoing;
3. Reschedule activities to achieve maximum practical concurrency of activities;
4. Expedite delivery of materials.

C. Schedule Revisions:
1. Notify the Architect of the specific measures taken or planned to increase the rate of progress together with an estimate of when scheduled progress will be regained.
2. Submit revised CPM network and activity reports showing implementation of planned recovery measures and schedule revisions.

1.9 FLOAT

A. Definition of Float:
1. Free Float: The length of time the start of any activity can be delayed without delaying the start of a successor activity.
2. Total Float: The length of time along a given network path that the actual start and finish of activity(s) can be delayed without delaying the Contract Completion Date.
3. Project Float: The length of time between the Contractor's early completion date and the Contract Completion Date.

B. Ownership of Float: Schedule float available within the construction schedule at any time is not for the exclusive use or benefit of either the Owner or the Contractor but is a jointly owned, expiring project resource available to both parties as needed to meet contract milestones and the Contract Completion Date.

C. The Owner may require various changes in the Work. Pursuant to the float sharing provisions of this Section, no time extensions will be granted nor delay damages paid unless a delay occurs that impacts activities currently on the critical path, consumes all available float, and extends completion of the Work beyond the current Contract Completion Date.

D. Non-Sequestering of Float:
1. The use of float suppression techniques such as preferential sequencing or logic (arranging critical path activities more susceptible to Owner caused delay), special lead/lag logic restraints, zero total or free float constraints, extended activity times, or imposing constraint dates other than as required by the Contract are prohibited,
2. The use of resource leveling (or similar software features) used for the purpose of artificially adjusting activity durations to consume float and influence the critical path is prohibited.
3. Sequestering of float shall be cause for rejection of the Contractor's schedule submittal.

E. Negative Float: Negative float will not be the basis for requesting time extensions. Scheduled completion date(s) that extend beyond the Contract Completion Date may be used in computations for assessment of liquidated damages withholdings.

1.10 VOLUNTARY ACCELERATION

A. Early completion or voluntary acceleration of the schedule by the Contractor is acceptable provided that:
1. The Owner is agreeable to such acceleration and so notifies the Contractor in writing;
2. At the time of submission of the Preliminary Network Analysis, such acceleration is clearly indicated and the Owner is notified of actions on the Owner's part necessary to accommodate the change or acceleration;
3. The Owner is compensated for any inconvenience or expense associated with such acceleration.

4. The time between early completion date and the Contract Completion date is identified as a schedule activity as “contractor early completion” and shall be considered as project float.

B. The Owner may require various changes in the Work. Pursuant to the voluntary acceleration provisions of this Section, no time extensions will be granted nor delay damages paid until a delay occurs that impacts activities currently on the critical path, consumes all available float, and extends completion of the Work beyond the current Contract Completion Date.

1.11 PROJECT SCHEDULE

A. Contract Time: As established by the Agreement Between the Owner and Contractor and amended by change order.

B. Progress of the Work:
1. Time is of the essence in the performance of this Contract.
2. Schedule the Work in such a manner as to provide for timely completion.
3. Begin schedule with the Notice to Proceed and conclude with the late-finish date of the critical path on the Contract Completion Date which shall be the date of Notice of Completion.

C. Plan of the Work: The schedule shall reflect Contractor’s actual plan for prosecution of the Work.

D. DSA Oversight Process: In connection with the DSA Construction Oversight Process, which includes the use of inspection cards and review of changes to the DSA-approved construction documents, the Contractor must (a) include specific tasks in its baseline schedule to take into account these procedures since they are critical path issues; and (b) include a reasonable amount of float in the baseline schedule to accommodate the additional time required by these DSA procedures.

E. Detail: Time scale network diagram in calendar days and prepare at level of detail and logic which will schedule as separate activities all salient features of the Work. At a minimum, include:
1. Project mobilization.
2. Schedule preparation and updates.
3. Submittal and shop drawing preparation.
4. Review and DSA approval of deferred approvals.
5. Review of submittals and shop drawings for critical materials and equipment.
6. Procurement, fabrication, delivery, and installation of major equipment and critical materials.
7. Testing and inspection.
8. Significant activities of the work of each trade.
    a. Separate plumbing, mechanical, and electrical into underground, rough-in, and finish activities.
    b. Separate concrete work activities into footings, exterior walks, interior slabs, curbs/mowstrips.
9. Separate the following systems from other power and lighting electrical activities:
    a. Fire alarm system.
    b. Data, telephone, intercom / clock, intrusion alarm, audio visual systems.
10 Power shut-downs.
11. All milestone dates.
12. Testing of concrete floor slabs for moisture and pH.
13. Remediation of concrete floor slabs due to unsatisfactory moisture or pH conditions.
14. Final clean-up.
15. Start-up and testing.
16. Commissioning.
17. Correction list work.
18. Building flush out (100% outside air for 14 days).

19. Demobilization.
20. Closeout documentation.

F. Activity / Event Constraints: Day / time constraints other than those required by the Contract Documents are not permitted.

G. Leads and Lags: Lead or lags shall not be used when the creation of an activity will perform the same function (e.g., concrete cure time). Lag durations contained in the schedule shall not have a negative value. The use of any lead or lag will be explained in the Narrative Report.

H. Provide for schedule, logic, and operating constraints of the Work as specified in Section 01 1100.

1.12 NETWORK DIAGRAM

A. Format:
1. Precedence format time-scaled in calendar days.
2. Read from right to left, in ascending order for each activity.
3. Allow space for notations and revisions.
4. 30" by 42" maximum sheet size. If multiple sheets are required, keep activities of a building or site quadrant on the same sheet.
5. Include abbreviations legends, sheet numbers, revision numbers, codes, and date of run.
6. Print network diagram in color to clearly identify planned work, completed work, and critical path activities.

B. Organization:
1. Graphically illustrate order and interdependence of all activities and sequence of work; how start of a given activity depends on completion of preceding activities; and how completion of the activity may restrict or restrain start of following activities.
2. Organize diagram by early start date and show a continuous flow from left to right with no logic (relationship lines) from right to left. With the exception of start project and end project milestone activities, no activities shall be open-ended; each activity shall have predecessor and successor ties.
3. Graphically group activities of separate stages and buildings, **do not use a random (or scattered) format.**
4. Keep groups of activities defining a building or site quadrant on the same sheet.

C. Critical Path:
1. Clearly indicate the critical path in a graphic manner (by color difference) on the network diagram.
2. **The Critical Path is the longest continuous path on the network diagram from start to finish of the Work.**

1.13 SCHEDULE ACTIVITIES

A. Schedule Activities:
1. 30 day maximum duration.
2. Limit activities to a single floor level.
3. Separate vertical activities from horizontal activities.
4. Separate site work into quadrants.
5. Separate on-site work from off-site work.
6. Separate off-site work into areas designated by street name.

B. Activity Information: Indicate the following information for each activity on network diagram:
1. Activity description.
2. Activity number.
3. Original duration in work days.

4. Actual duration in work days.
5. Early start date.
6. Early finish date.
7. Total float.
8. Status indicator (started or complete).
9. Responsibility code.

D. Milestone Activities: Indicate date on the diagram for each of the following milestone activities:
1. Start project: Start schedule no earlier than the contract award date and the project duration shall start on the Notice to Proceed date. Include activities named “contract award” and “start project,” both with zero duration and constrained start dates equal to the contract award and Notice to Proceed dates.
2. Interim phase start dates: Include as the first activity for each project phase, an activity named “start phase X” with a zero duration and an unconstrained start date equal to the contract phase start date. This unconstrained start date is not a waiver of a contractually required start date, but is left unconstrained to allow the schedule logic to calculate without hindrance.
3. Interim phase completion dates: Include as the last activity for each project phase, an activity named “end phase X” with a zero duration and an unconstrained late finish date equal to the contract phase completion date. This unconstrained completion date is not a waiver of a contractually required completion date, but is left unconstrained to allow the schedule logic to calculate without hindrance.
4. Early completion: If the Contractor’s schedule shows completion of the project prior to the Contract Completion Date, the Contractor shall include an activity named “contractor early completion” with a zero duration and an unconstrained date representing the Contractor’s early completion date.
5. End project: Include as the last activity an activity named “end project” with zero duration and a constrained late finish date equal to the Contract Completion Date. Calculation on project updates shall be such that if the late finish of the last activity falls after the Contract Completion Date, then the float calculation shall reflect a negative float on the critical path.

1.14 MATHEMATICAL ANALYSIS:

A. Tabulate each activity using calendar dates, and identify for each activity:
1. Preceding and succeeding activity numbers.
2. Activity description.
3. Estimated duration of activity.
4. Earliest start date.
5. Latest start date.
6. Earliest finish date.
7. Latest finish date.
8. Actual start date.
9. Actual finish date.
10. Percentage of activity completed.
11. Responsibility.
12. Original duration.
13. Remaining duration.
14. Total float.
15. Constraints.

B. Analysis Program:
1. Shall be capable of compiling completion status of completed and partially completed procurement and construction activities, and of accepting revised completion dates, and recomputation of all dates and float.
2. Do not automatically update start and finish dates by default mechanisms in the scheduling software. Actual start and finish dates shall be based on the actual progress of the Work.

C. Activity Reports: Generate activity reports as required by this Section based on mathematical analysis of the project schedule.

1.15 REQUIRED SCHEDULE REPORTS

A. Provide the following reports with each schedule submittal:
   1. Activity report: List of all activities sorted by building and site quadrant, and by order of earliest start date. Use actual start date for completed activities.
   2. Logic report: List of preceding and succeeding activities for every activity in ascending order by activity number. Use actual start and finish dates for started or completed activities.
   3. Float report: List of all activities sorted in ascending order of total float. List activities with the same amount of float in ascending order of early start date.
   4. Critical path report: Listing of activities on critical path in order of early start.
   5. Schedule change report: Identify all changes made to schedule since the previous monthly update including:
      a. Changes in logic, relations, and lag / leads.
      b. Changes in duration.
      c. Activity additions / deletions.
      d. Actual start/finish dates.
      e. Changes in completion status of activities by percentage of completion.
      f. Changes in critical status.

1.16 BAR CHART

A. Bar chart submittals shall graphically indicate schedule activities in a time-scaled bar chart format. Bar charts shall include the following information for each activity:
   1. Description.
   2. Number.
   3. Duration.
   4. Early and late start dates.
   5. Early and late finish dates.
   6. Total float.
   7. Status indicator (started or complete).

1.17 TWO-WEEK ROLLING SCHEDULES

A. On a weekly basis, review with the Owner and Architect the planned schedule of each active trade for the following two weeks.
   1. Two-week rolling schedule shall be part of the CPM schedule.
   2. Identify critical path activities.
   3. Provide bar chart type format on 8-1/2" by 11" sheets.

1.18 PROJECT CONTROL REPORTS

A. Prepare as a method of reporting pertinent project information, project control reports for the Owner's and Architect's information including:
   1. Activity report: List of all activities sorted by early start date. Use actual start date for completed activities: The cost-loaded schedule of values report, sorted by building and site quadrant, and then by order of earliest start date shall be the Schedule of Values.
   2. Updated Network Diagram, to graphically depict current status of Work, including change orders and time extensions.

3. Updated bar chart.
4. Updated activity reports for all reports required by Article 1.11.
5. Narrative Report describing:
    a. Changes in activities, original durations, logic interdependencies, milestones, planned sequence, and critical path.
    b. Pending items and status thereof, including permits, change orders and time extensions.
    c. Status of current Contract Completion Date and interim milestones.
    d. Description of current and future schedule problem areas.
    e. Current and anticipate delays (describe cause and corrective actions).

END OF SECTION 01 3220

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Make submittals required by the Contract Documents, and revise and resubmit as necessary to establish compliance with the specified requirements, all as described in this Section.
   1. The section includes requirements for building systems described as Deferred Approval Items on the drawings or in the specifications.

B. Related Sections:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. Other requirements for submittals may be described in pertinent Sections of these Specifications.
   3. Section 01 3560: High Performance Criteria Summary.

C. Work not Included:
   1. Submittals not required by the Contract Documents will not be reviewed by the Architect.
   2. The Contractor may require his subcontractors to provide drawings, setting diagrams, and similar information to help coordinate the Work, but such data shall remain between the Contractor and his subcontractors and will not be reviewed by the Architect unless specifically called for within the Contract Documents.

1.2 SUBMITTALS

A. Make submittals of Shop Drawings, Samples, substitution requests, and other items in accordance with the provisions of this Section.

B. Substitutions shall comply with the procedures for substitutions specified in Section 01 2500.

C. High Performance Criteria: Submit in accordance with Section 01 3560 - High Performance Criteria Summary under Submittals.

1.3 QUALITY ASSURANCE

A. Coordination of Submittals:
   1. Prior to each submittal to the Architect, the **General Contractor shall** carefully review and coordinate all aspects of each item being submitted.
   2. Verify that each item and the submittal for it conform in all respects with the specified requirements.
   3. By affixing the Contractor's signature to each submittal, certify that this coordination has been performed.

B. Accuracy of Submittals:
   1. By approving and submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements, and field construction criteria relate thereto, or will so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

2. The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's review or approval of Shop Drawings, Product Data, Samples, or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal requesting a substitution and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals by the Architect's review thereof.

1.4 USE OF ARCHITECT'S CAD DRAWINGS

A. General:
1. Electronic CAD files of the Contract Drawings may be provided for Contractor's convenience and use in preparing submittals, subject to the requirements of this Section.
2. All requests by subcontractors for CAD drawings shall be transmitted through the Contractor and CAD files released by the Architect shall only be released to the Contractor.

B. Requirements for Release of Architect's Electronic CAD Files:
1. Release of CAD files is subject to Contractor's acceptance of Architect's "Waiver of Liability for Electronic CAD Files", a copy of which is attached at the end of this section.
2. Receipt of executed liability waiver agreement is a condition precedent to releasing architectural CAD files.

C. Requirements for Release of Civil Engineer's Electronic CAD Files:
1. Cost of Civil Engineer's preparation of civil CAD files shall be borne by the Contractor and is in addition to the Contract Sum.
2. Release of civil CAD files is subject to Contractor's acceptance of Civil Engineer's "Waiver of Liability for Electronic CAD Files". Contact the Civil Engineer to obtain the waiver form.
3. Receipt of executed liability waiver agreement is a condition precedent to releasing civil CAD files.

D. The Contractor assumes all liability and risk for use of electronic CAD files. Architectural / engineering drawings are essentially diagrammatic in terms of graphics and are not intended to provide scalable dimensional accuracy. Electronic CAD files are an incomplete representation of the Contract Documents which may not include addendum information or hand drawn additions or modifications. In the event of a conflict between the signed and approved Construction Documents and the electronic CAD files, the signed and approved Construction Documents shall govern.

E. The transfer of CAD files to the Contractor is for the Contractor's convenience only, and does not in any way release the Contractor from the requirement to produce its own shop drawings by the normal method of preparing plans and details by drafting. Delays in the release of CAD files shall not relieve the Contractor of preparing submittals in a timely fashion and such delays shall not provide a basis for claims of delay and damages.

PART 2 - PRODUCTS

2.1 TYPES OF SUBMITTALS

A. Shop Drawings:
1. Scale and Measurements: Make Shop Drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the Work.
2. Types of Prints Required: Submit Shop Drawings in the form of blackline prints of each sheet.
3. Review comments of the Architect will be shown on the sepia transparency when it is returned to the Contractor. The Contractor may make and distribute such copies as are required for his purposes.

B. Manufacturer's Literature:
   1. Where contents of submitted literature from manufacturers includes data not pertinent to the submittal, clearly show and highlight the portion of the contents being submitted for review.
   2. Submit seven copies of each item.

C. Samples:
   1. Provide Sample or Samples identical to the precise article proposed to be provided. Identify as described under "Identification of Submittals" below.
   2. Provide three samples; one to be retained by the Architect, one to be returned to the Contractor, and one to be retained by the Inspector of Record.

D. Colors and Patterns: Unless the precise color and pattern is specifically called out in the Contract Documents, and whenever a choice of color or pattern is available in the specified products, submit accurate color and pattern charts to the Architect for selection.

2.2 ELECTRONIC SUBMITTALS

A. Electronic submittal are acceptable in lieu of hard copies providing the following requirements are met:
   1. Submittal shall be in PDF format, with book marks for table of contents and each tab, and sub-bookmarks for each item.
   2. All text shall be searchable, except text that is part of a graphic.
   3. Submittal shall include all items required by the Contract Documents, except a binder is not required.
   4. Electronic submittals shall be processed through normal channels. Do not submit directly to the Architect's consultants.
   5. Contractor shall provide Owner and Inspector with hard copies of the final Submittal. Coordinate exact number required with the Architect.
   6. One hard copy of any submittal may be required upon the Architect's request for use during review.

B. Electronic submittals which do not comply with the above requirements will be rejected.

PART 3 - EXECUTION

3.1 IDENTIFICATION OF SUBMITTALS

A. Consecutively number all submittals.
   1. When material is submitted for any reason, transmit under a new letter of transmittal and with a new transmittal number.
   2. On resubmittals, cite the original submittal number for reference.

B. Accompany each submittal with a letter of transmittal showing all information required for identification and checking.

C. On at least the first page of each submittal, and elsewhere as required for positive identification, show the submittal number in which the item was included.

3.2 GROUPING OF SUBMITTALS

A. Unless otherwise specified, make submittals in groups containing all associated items to assure that information is available for checking each item when it is received.
   1. Partial submittals may be rejected as not complying with the provisions of the Contract.
   2. The Contractor may be held liable for delays so occasioned.

3.3 TIMING AND REVIEW OF SUBMITTALS

A. Make submittals far enough in advance of scheduled dates for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.

B. In scheduling, allow at least 30 calendar days for review by the Architect following the Architect's receipt of the submittal, unless mutually agreed otherwise in writing by the Architect and the Contractor.

C. Resubmittal Costs: The Architect and the Architect's consultants will review the original submittal only as part of their services to the Owner. If the time expended in resubmittal reviews exceeds normal resubmittal review time, the costs of resubmittal reviews by the Architect or the Architect's consultants will be paid to the Architect by the Owner as additional services on an hourly basis.
   1. The Architect will bill the Owner for the additional services required by the Architect and/or the Architect's consultants for such resubmittal reviews, time expended, and reimbursable expenses incurred, and the Owner shall be reimbursed by deducting the same amount from the Contractor's subsequent Application for Payment.

3.4 DEFERRED APPROVAL ITEMS

A. Deferred Approval:
   1. Certain items of this project are identified for DSA Deferred Approval on the drawings.
   2. DSA Deferred Approval items require additional lead time to obtain approval from DSA. The Contractor shall take into consideration that DSA reviews may take as much as 90 days.
   3. Delays due to the failure of the Contractor to properly account for reasonable DSA review periods shall be the sole responsibility of the Contractor.

B. Deferred Approval Items: Deferred approval items are listed on the Cover Sheet of the Drawings.

C. Refer to DSA PR 18-04 for specific procedures as required by DSA. These procedures include but are not limited to specific file formatting, .pdf bookmarking, etc.

3.5 REQUIRED SUBMITTALS

A. Provide Submittals as required by each Specification Section.

END OF SECTION 01 3300

WAIVER OF LIABILITY FOR ELECTRONIC CAD FILES

Electronic CAD files for [Project Name and Location], have been requested by CONTRACTOR. These files are being provided, subject to the following terms and conditions, pursuant to the acceptance and execution of this agreement. For the purposes of this agreement the term ARCHITECT shall mean the Architect and all of its Consultants.

Electronic files provided are compatible with AutoCAD. ARCHITECT makes no representation as to the compatibility of these files with CONTRACTOR'S hardware or software. Due to the potential that the information presented on the electronic files can be modified, unintentionally or otherwise, ARCHITECT has the right to remove all indicia of ownership and or all involvement from electronic display.

Data contained on these electronic files are part of ARCHITECT'S instruments of service which are copyrighted and proprietary in nature and shall not be used by CONTRACTOR or any other entity receiving this data through or from CONTRACTOR for any purpose other than as a convenience in the preparation of shop drawings and field engineering for the referenced project. The CONTRACTOR agrees that the use of digital information provided by the ARCHITECT for any purpose or activity that constitutes the practice of Land Surveying and/or Civil Engineering, as defined by the California Business and Professions Code, will be by or under the direct supervision of a Land Surveyor or Civil Engineer licensed to practice in the State of California. Such practices include, but are not limited to creating a GPS model for earthwork. Any use or reuse by CONTRACTOR or by others will be at CONTRACTOR'S sole risk and without liability or legal exposure to ARCHITECT.

The transfer of electronic files to CONTRACTOR is for the CONTRACTOR'S convenience only, and does not in any way relieve CONTRACTOR from the requirement to produce shop drawings by the normal method of preparing plans and details by drafting. Delays in release of CAD files shall not relieve CONTRACTOR of responsibility for preparing shop drawings or providing field engineering in a timely fashion and such delays shall not provide a basis for claims of delay and damages.

The CONTRACTOR agrees to reciprocate with the ARCHITECT, upon request, relative to drawing files produced by it or its subcontractors for the subject project, under the same conditions as we have received digital files from the ARCHITECT.

The CONTRACTOR assumes all liability and risk for use of architectural / engineering electronic CAD files and agrees these electronic files are not construction documents and that differences may exist between these electronic files and corresponding hard copy construction documents. Electronic CAD files are an incomplete representation of the Contract Documents which may not include addendum information or hand drawn additions or modifications. In the event a conflict arises, signed and sealed hard copy construction documents will govern. By using these electronic files the CONTRACTOR is in no way relieved of its duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate work with that of other CONTRACTORS on the project.

CONTRACTOR recognizes the instability of electronic storage media and that the transfer of electronic data may not be total or accurate, because of equipment and/or software incompatibility, or changes that may be made by CONTRACTOR and/or other entities receiving this data through or from CONTRACTOR during the editing of the information provided.

CONTRACTOR agrees to make no claim, and hereby waives, to the fullest extent permitted by law, any claim or cause of action against ARCHITECT, ARCHITECT'S officers, directors, employees, agents, or consultants that may arise out of or in connection with CONTRACTOR'S use of the electronic files. CONTRACTOR agrees to the fullest extent permitted by law, to indemnify and hold ARCHITECT and OWNER harmless from any damage, liability, or cost, including reasonable attorneys' fees and costs of defense, arising from any reuse or modification of the plans and specifications by CONTRACTOR or any person or entity which acquires or obtains the plans and specifications. In no event shall ARCHITECT or OWNER be liable for any loss of profit or any damages. It is understood that CONTRACTOR shall be solely responsible for verification of conditions and coordination of their work into the work product.

Under no circumstances shall delivery of the electronic files to CONTRACTOR be deemed a sale by ARCHITECT, and ARCHITECT makes no warranties, either express or implied, of merchantability and fitness for any particular purpose.

CONTRACTOR Name	Printed Name and Title
CONTRACTOR Address	Authorized Signature
	Date

List drawing sheets requested below or attach separate list:

SECTION 01 4130 - OFFSITE DEVELOPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all labor, materials and equipment necessary to provide, construct and install off-site development and improvements

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Standards: Comply with the Standard Drawings and Specifications of the Authority Having Jurisdiction.

B. All work shall comply with the rules and regulations of the Division of Industrial Safety and all other local, state and federal agencies having jurisdiction. Nothing contained herein shall be construed as permitting work that is contrary to such rules, regulations and codes.

C. Full compensation for all costs involved in worker protection from caving ground in excavating shall be included in the lump sum price bid for the work under this contract.

1.3 SUBMITTALS

A. Comply with all requirements of the Authority Having Jurisdiction regarding submittals.

B. Submit all test reports for compaction.

1.4 SCOPE OF WORK

A. Street Improvements: Construct street improvements as indicated on the Drawings, as specified, and in conformance with the Standard Plans and Specifications of the Authority Having Jurisdiction.

B. Sewer and Water Facilities: Construct sewer and water facilities as indicated on the Drawings, as specified, and in conformance with the Standard Plans and Specifications of the Authority Having Jurisdiction.

C. Storm Drain Facilities: Construct storm drain facilities as indicated on the Drawings, as specified, and in conformance with the Standard Plans and Specifications of the Authority Having Jurisdiction.

D. Power and Telephone Utilities: Coordinate with and schedule the work of utility providers regarding their work of relocating and/or undergrounding their facilities within the street right of ways adjacent to the school site.
   1. Contractor shall establish and maintain communication with the utility companies regarding his schedule and that of the utility companies.
   2. Prepare street and sidewalk subgrade so that the utility providers can trench for their underground facilities.
   3. Establish surveyed street curb grades and alignments for the utility providers so that they may accurately locate their facilities; and the possible requirement to schedule his work around existing utility poles until such time as the utility companies complete their relocation or installations.

E. **Multiple move-ins of equipment and personnel may be required and will not be considered additional cost.**

1.5 EXISTING CONDITIONS

A. Contractor shall be held to have visited the site prior to submitting proposal to determine existing conditions, nature of materials to be encountered and to evaluate other information concerning or affecting the work to be performed under the contract.

B. Before commencing excavation, the Contractor shall notify all utility authorities or utility companies having possible interest in the work of the Contractor's intention to excavate proximate to existing facilities and Contractor shall verify the location of any utilities within the work area.

C. Engineer has made a diligent attempt to show on the Drawings all pertinent intersecting utilities which may affect the work. Utilities shown in profile view are shown at their most probable locations, based upon available as-built drawings and known construction custom. The Contractor shall exercise caution while performing excavation for this project and shall protect existing utilities from damage, inasmuch as their exact location is unknown until exposed by the excavation.

D. Because of the close proximity of certain existing parallel or intersecting utilities and the depth of the proposed facilities, it may be necessary for the Contractor to provide special protection for the existing utility, and/or provide for its temporary and/or permanent relocation in order to construct the facilities shown on the Drawings. Bracing of power poles may be necessary. The Contractor shall coordinate said work and shall be responsible for complying with the requirements of the utility authority involved. Full compensation for all costs involved in such special protection and/or relocation, including all appurtenances and incidentals, shall be included in the amount bid, and no separate payment shall be made therefor.

E. All existing utility mains and service lines shall be kept in constant service during the construction of this project. Hand excavating shall be employed where necessary to safely expose existing utilities.

F. Full compensation for all costs involved in locating, verifying, protecting, exposing, relocating, reconstruction and otherwise providing for utilities shall be included in the amount bid for the various items of work and no separate payment shall be made therefor.

1.6 DUST AND TRAFFIC CONTROL

A. Dust Control: The Contractor shall maintain dust control about the site of the work, including any haul roads to or from the site, by whatever means are necessary, such as watering, sweeping or oiling, so as to cause the least possible dust nuisance to the public. Any dust control measure ordered by the Architect shall be promptly and immediately carried out.

B. Traffic Control:
   1. Traffic control measures shall be fully and completely carried out at all times to the satisfaction of the Authority Having Jurisdiction. If the Contractor fails to provide satisfactory traffic control the Owner may obtain services from other sources and deduct from the contract the cost thereof.
   2. Through traffic shall be provided for during non-working hours including, but not limited to, weekends, holidays and at night.
   3. The Contractor shall comply with all requirements of the Street Encroachment Permit.

1.7 PROTECTIVE MEASURES

A. Furnish, place, and maintain all supports, shoring, and sheet piling which may be required for the sides of excavation or for protection of adjacent existing improvements. The adequacy of such systems is the sole responsibility of the Contractor.

B. Maintain all bench marks, monuments and other reference points. If disturbed or destroyed, replace as directed.

C. 48 hours prior to beginning construction, the Contractor shall notify the owners of all properties adjacent to the proposed construction. The Contractor shall also provide the property owners with an estimate of the length of time that their properties will be affected by his construction activities.

1.8 PERMITS

A. The Contractor shall secure and pay for all permits required for work under this contract including, but not limited to, the Authority Having Jurisdiction's Encroachment Permit.

B. All costs associated with obtaining permits as required by construction and as indicated herein shall be included in the price bid for the various items of work and no separate payment will be made therefor.

C. The Contractor shall pay all inspection fees required by governmental agencies.

1.9 FINISH ELEVATIONS AND LINES

A. Surveying for offsite improvements shall be provided by the Contractor.

B. Carefully preserve all data and monuments and, if displaced or lost, immediately replace such monuments to the satisfaction of the Architect and at no additional cost to the Owner.

1.10 REPRESENTATION ON PLANS

A. The basic topographic ground feature information shown on the Drawings was obtained by field survey. The Contractor shall carefully examine the site of work and shall satisfy himself as to the conditions to be encountered, any changes thereto which have occurred, and any condition or feature which needs additional investigation.

1.11 MONITORING OF CONSTRUCTION SITE

A. Contractor shall monitor the construction site on a regular basis during non-working hours, including weekends and holidays to ensure that no situations arising, relating to the condition of the work site, which could pose a threat to public safety. In addition the contractor shall furnish to the Owner, to the Authority Having Jurisdiction prior to the issuance of the "Notice to Proceed", a list of persons, together with their addresses and home telephone numbers, who are authorized to act on behalf of the Contractor in an emergency arising out of conditions at the work site after normal working hours.

B. Safe pedestrian crossings shall be maintained at all existing crosswalks and intersections.

C. The Contractor shall secure the site of work at all times. Children shall not be allowed in or along the excavation, on spoil piles or at other undesirable locations within the work. The Contractor shall provide suitable traffic and pedestrian warning devices and signs necessary at or near the work as required by safety considerations and/or jurisdictional authorities. Convenient pedestrian detours and/or flagmen and/or safe temporary bridges over excavations, complete with adequate safety rails, shall be provided as necessary.

1.12 COMPACTION AND COMPACTION TESTS

A. The Contractor shall be fully responsible for timely compaction and suitability of material for compaction. Where necessary, wet and pumping material shall be removed from the trench or excavation by the Contractor and replaced with suitable approved material as necessary to complete operations within the times allowed.

B. Compaction requirements for all excavations within public streets shall be in accordance with the Encroachment Permit and in accordance with the Standard Specifications of the Authority Having Jurisdiction.

C. Initial compaction testing shall be provided by the Owner. The Contractor shall file adequate notice to the engineer when he desires compaction testing. All required compaction retesting of backfill because of failure to pass the initial compaction test shall be at the expense of the Contractor.

D. Full compensation for all costs involved in meeting and satisfying the above requirements shall be included in the amount bid for the various items of work and no separate payment will be made therefor.

1.13 FEES

A. Fees for the offsite street improvements are clarified as follows:
   1. Fees to be paid by Contractor and to be included as part of his bid:
      a. Inspection Fees
      b. Encroachment Permit Fees
   2. Fees to be paid by Owner:
      a. Deed Check Fee
      b. Plan Review Fee

B. Contractor shall also be responsible to secure and pay for the Encroachment Permit, as well as all the required bonds and insurance. All references made by the "General Notes for Street Construction" to the "Developer" shall be interpreted to mean "Contractor", except "The Owner shall pay for all initial compaction tests". Contractor shall pay for all required retests.

1.14 RECORD DRAWINGS

A. Comply with all requirements of Section 01 7840 of these Specifications.

B. These records drawings required for the storm drainage facilities shall contain all of the information and shall fulfill all of the requirements outlined in Section 01 7840 of these Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials incorporated in street, water, sewer and storm drain facilities construction shall conform with the Standard Plans and Specifications of the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXECUTION

A. Construction of water and street facilities shall be performed in accordance with the Standard Plans and Specifications of the Authority Having Jurisdiction.

B. Contractor shall be responsible to protect all other existing and proposed utilities and improvements affected by his work.

C. Contractor shall cooperate with all other contractors on the job to insure that his activities do not delay or hinder the construction activities of others.

D. All excess earth from trenching and offsite grading may be deposited within the boundaries of the Elementary School development at a location specified by the Architect for incorporation in site grading activities. All such earth shall be free of organic material, large rocks, hardpan, asphaltic paving and other deleterious materials.

E. The Contractor shall be aware that the work of this contract is a portion of the total work required for the construction of the Project. The Contractor shall coordinate his work and his schedule fully with other forces performing work relating to the construction of the above stated site development. Included in these "other forces" are utility providers, the forces constructing on-site improvements for the above stated site development and any other forces performing work within the project area which requires coordination with the work of this contract.

F. The Contractor shall coordinate his efforts with other forces performing on-site work such that said forces are provided with adequate access to the site.

G. The Contractor shall notify the Authority Having Jurisdiction forty-eight hours prior to beginning construction.

END OF SECTION 01 4130

SECTION 01 4320 - DSA CONSTRUCTION OVERSIGHT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section describes the oversight provided by the Division of the State Owner (DSA) for projects under its jurisdiction.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
1. Section 01 2600: Contract modification procedures and forms.
2. Section 01 4520: Testing and inspection services.

1.2 DEFINITIONS

A. The following definitions apply to terms used in this Section:
1. DSA Approved Construction Documents: Portions of plans, specifications, addenda, deferred submittals, revisions, and construction change documents (CCDs) duly approved by DSA that contain information related to, and affecting Structural Safety, Fire/Life Safety, and Accessibility. While all portions of the construction documents may contain a DSA identification stamp, this stamp is not the approval. The DSA approval is indicated by a letter to the District. This letter clarifies that the approval is limited to Structural Safety, Fire/Life Safety and Accessibility.

1.3 DSA PROCEDURES, INTERPRETATION OF REGULATIONS, AND FORMS

A. The requirements of the following DSA procedural documents shall apply to this Section:
1. DSA Procedure PR 13-01: Construction Oversight Process.

B. The requirements of the following DSA Interpretation of Regulations documents shall apply to this Section:
1. DSA IR A-8: Project Inspector and Assistant Inspector Duties and Performance.
2. DSA IR A-13: Stop Work and Order to Comply.

C. The Project Inspector, assistant inspectors, Laboratory of Record, Architect, other design professionals, and the Owner shall communicate project information and make certain reports pertaining to the status of construction compliance using the following DSA forms:
1. DSA 1 Application for Approval of Plans and Specifications
2. DSA 5 Project/Special Inspector Qualification Record
3. DSA 6-AE Architect/Engineer Verified Report
4. DSA 6-C Contractor Verified Report
5. DSA 6-PI Project Inspector Verified Report
6. DSA 102-IC Construction Start Notice/Inspection Card Request
7. DSA 103 Statement of Structural Tests and Special Inspections
8. DSA 130 Certificate of Compliance - Approved Bleacher/Grandstand Fabricator
9. DSA 140 Application for Approval of Construction Change Document.
10. DSA 151 Project Inspector Notifications
11. DSA 152 Project Inspector Card
12. DSA 154 Notice of Deviations/Resolution of Deviations
13. DSA 155 Project Inspector Semi-Monthly Report
14. DSA 156 Commencement/Completion of Work Notification
15. DSA 291 Laboratory of Record Verified Report

16. DSA 292 Special Inspectors Employed Directly by the District Verified Report
17. DSA 293 Geotechnical Verified Report

1.4 QUALITY ASSURANCE

A. Project Inspector: The Owner shall employ a DSA approved Project Inspector in accordance with the requirements of the California Code of Regulations, Title 24. The Inspector's duties are specifically defined in Title 24, Part 1, Section 4-342.
   1. The work of construction in all stages of progress shall be subject to the personal continuous inspection of the Inspector.
   2. The Inspector shall have free access to any or all parts of the work at any time.
   3. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep the Inspector fully informed respecting the progress and manner of the work and character of the materials.
   4. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract.

B. DSA Construction Oversight: California Code of Regulations (CCR), Title 24, Part 1, Chapter 4, Article 1 (Sections 4-201 through 4-222) and Group 1, Articles 5 and 6 (Sections 4-330 through 4-344) provide regulations governing the construction process for projects under the jurisdiction of DSA.
   1. Observation of Construction by DSA: The DSA District Engineer conducts occasional site walks to make observations as necessary to ascertain that inspections have been completed diligently. During the site visit, the DSA District Engineer may provide guidance to the Project Inspector, as needed, to ensure enforcement of construction documents.
   2. DSA Field Trip Notes: At the conclusion of the site visit, the DSA Field Engineer issues a Field Trip Note (form DSA 135 or comparable) to the Project Inspector, who shall distribute the field trip note to the school Owner and the responsible design professional.
      a. The field trip note indicates any findings by the Field Engineer that require action by the Project Inspector and/or the Architect and other responsible design professionals to ensure project compliance with Field Act requirements.
      b. The field trip note may include informational comments, including construction status and guidance given to the Project Inspector.
      c. The field trip note becomes a part of the DSA project records.

C. Testing and Special Inspection: Testing required for the project is specified in Section 01 4520 - Testing and Special Inspection Services.
   1. Form DSA-103 is attached to Section 01 4520.
   2. Testing may be required by other Sections that is not specifically noted on Form DSA -103.

1.5 PROJECT INSPECTOR

A. General: The Project Inspector shall perform specific duties in accordance with Title 24, Part 1 (Sections 4-333 and 4-342).
   1. The Project Inspector acts under the direction of the Architect and is subject to supervision by DSA.
   2. The Project Inspector does not have the authority, under Title 24, to direct the Contractor in the execution of the work, nor to stop the work of construction.

B. Code Prescribed Duties:
   1. Maintain Job File: The Inspector shall maintain Project records.
   2. Comprehend of the Construction Documents: The Project Inspector shall study and fully comprehend the requirements of the construction documents in order to provide competent inspection of the work. The Inspector shall:
      a. Consult Architect and other responsible design professionals to resolve uncertainties in the Inspector's comprehension of the plans and specifications prior to construction of that portion of

the work.

b. Review requirements for each phase of the construction with the Contractor prior to commencing that phase of the work.
c. Readily identify non-compliant work as the construction progresses to facilitate prompt corrective action.
d. Verify code-compliant implementation of the materials testing and special inspection program.
e. Be involved in the Contractor's interpretation of the construction documents in accordance with Title 24, Part 1, Section 4-343.

3. Continuous Inspection of the Work:
   a. Provide complete and timely inspection of every part of the work.
   b. Provide prompt verbal notification to the Contractor of any deviation so that the deviation can be immediately corrected.
   c. The Project Inspector shall have personal knowledge of the construction, obtained through the Project Inspector's own physical inspection of the work in all stages of its progress.
4. Maintain Records of Inspections: The Inspector shall maintain detailed records of all inspections.
5. Communications Required of the Inspector: The Inspector shall during the course of construction, provide specific code-prescribed notices and reports to the Architect, other responsible design professionals, DSA, the Owner, and the Contractor.
6. Inspector's Monitoring of the Materials Testing and Special Inspection Program: The Inspector is responsible, under the direction of the Architect, for monitoring the work of the laboratory of record (LOR) any Special Inspectors hired directly by the Owner to ensure that all materials testing and special inspections required for the project are satisfactorily completed in accordance with the DSA approved documents. The Project Inspector shall monitor the following aspects of the structural testing and special inspection program:
   a. When DSA approval for special inspectors is required for Owner-employed special inspectors, the Project Inspector shall identify and report any special inspectors on the job site that are not DSA approved.
   b. The Project Inspector shall verify that the Laboratory of Record (LOR) is included on the List of DSA Accepted Testing Laboratories on the DSA website.
   c. The Project Inspector shall verify that the LOR and special inspectors have received sufficient advance notification to perform the required material sampling or special inspection.
   d. The Project Inspector is responsible for verifying that all required material sampling and special inspections have been performed. The Project Inspector is also responsible to observe any special Inspector's on-site presence, performance of duties, the special inspector's documentation of complying and non-complying work, and issuance of deviation notices.
   e. The Project Inspector shall report on DSA 155 the status and resolution of deviations reported by any LOR or special inspector.
7. Monitoring of Assistant Inspectors: The Project Inspector shall provide technical guidance to assistant Inspectors and shall verify the assistant inspectors' comprehension of the construction documents.
   a. The Project Inspector shall also monitor the assistant Inspectors' performance, verifying that the assistant inspectors are properly checking the construction, recording inspections, and performing other assigned duties.
   b. The Project Inspector shall ensure that any assistant inspector is performing the duties indicated on the assistant Inspector's approved form DSA 5-AI.
   c. The Project Inspector shall provide continuous on-site supervision of all assistant Inspectors.

C. Prohibited Duties: The Project Inspector is prohibited from performing functions associated with actual construction work such as:
   1. Performing construction work.
   2. Ordering or purchasing materials.
   3. Directing the work of the Contractor, Sub-Contractors, volunteer labor, or any entity performing construction work.
   4. Coordinating or scheduling the construction work.

5. Performing "quality control" of construction.
    a. Quality control is the responsibility of the Contractor.
    b. Quality assurance is the responsibility of the Project Inspector.

D. Ancillary Duties: The Project Inspector may perform duties for the Owner that are not code-prescribed as long as such duties do not interfere with inspection duties.
1. It is the Inspector's responsibility to report all ancillary duties to DSA, the Architect, and the structural engineer.
2. The Inspector shall also report unforeseen time demands that are impacting, or will impact, his or her ability to perform code-prescribed duties.
3. DSA may approve a Project Inspector when (in the opinion of DSA) these ancillary duties would not create a conflict of interest. DSA may withhold approval of a Project Inspector or withdraw approval at any time if the appearance of a conflict of interest arises.

1.6 DSA CONSTRUCTION OVERSIGHT PROCESS

A. Project Inspection Card (Form DSA 152): DSA will issue Project Inspection Cards for each project.
1. The number of inspection cards issued varies by project types. In general, one inspection card is required for each separate building and one for the site work, which includes non-building site structures.
2. The project inspection cards are issued electronically by upload to DSA Box.

B. Use of Project Inspection Card:
1. The Project Inspection Card is considered to be an interim verified report by the project inspector.
2. The Project Inspector signs off the applicable blocks and sections on the form as the work progresses. When signing off the blocks and sections of the form, the Project Inspector is verifying that:
    a. Identified areas are determined to be in compliance with the DSA approved construction documents,
    b. Required testing and inspections are complete, and
    c. Required documentation has been received by the Project Inspector.

C. Project Posting of Forms DSA 152: The Project Inspector shall post the forms in his Job File and shall electronically upload the forms to DSA Box.
1. The information in the forms shall always be current. Each time the form is updated, a new electronic posting is required such that the electronically posted form is always kept current.
2. The Project Inspector shall:
    a. Immediately, upon request, make the form available for review by any parties involved in the construction.
    b. Include a current copy of the forms any time a Verified Report (form DSA 6-PI) is submitted.
    c. Upon request, provide a current copy of the forms to DSA, the Owner, or the Architect.

D. Duties of the Inspector of Record: The Inspector shall provide notifications to DSA, Inspector's Semi-monthly Reports, deviation notices, record of communications to the Architect and other responsible design professionals, report the following communications during the course of a construction project which include:
    a. Notifications to DSA: Start of work, minimum 48 hours prior to completion of foundation trenches, minimum 48 hours prior to first concrete placement, and when work is suspended for more than one month.
    b. Semi-monthly Reports: Make semi-monthly reports (on the 1st and 16th of every month) on the progress of construction, on the form DSA 155 and submitted to the Architect and structural engineer, with a copy sent to DSA and the Owner.
    c. Deviation Notices: When the Inspector identifies deviations from the DSA approved plans and specifications, the Inspector shall verbally notify the Contractor. If the deviation is not immediately corrected, the Inspector shall promptly issue a written notice of deviation on form DSA 154 to the Contractor, with a copy sent to the Architect and DSA. The status and resolution of all deviations shall be

documented on semi-monthly reports.

d. Record of Communications to the Architect and other Responsible Design Professionals: All uncertainties in the Inspector's or Contractor's comprehension of the documents shall be reported in writing to the Architect and other responsible design professionals.
e. Reporting for Projects with Work Stoppage: This may be required in cases where DSA issues a Stop Work Order, Order to Comply or a request for Owner to stop work.
f. Verified Reports: Submit verified reports on form DSA 6-PI directly to DSA, with copies to the Architect, other responsible design professionals, and the Owner upon any of the following:
    1) Work on the project is suspended for a period of more than one-month.
    2) The services of the Inspector are terminated for any reason prior to completion of the project and such termination is not a result of work stoppage.
    3) DSA requests a verified report.
    4) At the time of occupancy of any building involved in a project prior to completion of the entire DSA approved scope of work.
    5) The entire project is substantially complete. DSA considers the project to be complete when the construction is sufficiently complete in accordance with the DSA approved construction documents so that the Owner can occupy or utilize the project for its intended use, as determined by the Owner and the Architect.

D. Duties of the Laboratory of Record:
1. Meet with the project inspector, design professionals, and the Contractor as needed to mutually communicate and understand the testing and inspection program, and the methods of communication appropriate for the project.
2. Obtain a copy of the DSA approved construction documents from the Architect prior to the commencement of construction.
3. Obtain a copy of the DSA approved Statement of Structural Tests and Special Inspections (form DSA 103) from the Architect prior to the commencement of construction.
4. Report all project related activities to the project inspector. The Project Inspector is responsible for monitoring the work of the Laboratory of Record and Special Inspectors to ensure the testing and special inspection program is satisfactorily completed.
5. Provide material testing as identified in the DSA approved construction documents.
6. Submit test reports to the project inspector on the day the tests were performed for any tests performed on-site.
7. Submit material test reports in a timely manner such that construction is not delayed and not to exceed 14 days from the date the material tests were performed to DSA, the Architect, structural engineer, project inspector and the Owner.
8. Immediately submit reports of material tests not conforming to the requirements of the DSA approved construction documents to DSA, the Architect, structural engineer, project inspector and the Owner.
9. The Engineering Manager shall submit an interim Laboratory of Record Verified Report (form DSA 291) and the Geotechnical Engineer shall submit an interim Geotechnical Verified Report (form DSA 293) to DSA, the project inspector, Owner and the Architect upon any of the following events occurring:
    a. Within 14 days of the completion of the material testing/special inspection program.
    b. Work on the project is suspended for a period of more than one month.
    c. The services of the Laboratory of Record are terminated for any reason prior to completion of the project.
    d. DSA requests a verified report.
    e. The Engineering Manager shall submit an interim verified report (form DSA 291) and the Geotechnical Engineer shall submit form DSA 293 to DSA and a copy to the Project Inspector for each of the applicable sections of the form DSA 152, prior to the Project Inspector signing off that section of the project inspection card, if that section required material testing.

E. Duties of Special Inspectors Employed by the Laboratory of Record:
   1. Meet with the Project Inspector, Architect, and the Contractor as needed to mutually communicate and understand the testing and inspection program, and the methods of communication appropriate for the project.
   2. Report all project related activities to the Project Inspector. The Project Inspector is responsible for monitoring the work of the Laboratory of Record and special inspectors to ensure the testing and special inspection program is satisfactorily completed.
   3. Perform work under the supervision of the Engineering Manager for the Laboratory of Record.
   4. Perform inspections in conformance with the DSA approved construction documents, applicable codes and code reference standards.
   5. Prepare detailed daily inspection reports outlining the work inspected and provide the Project Inspector a copy of the reports on the same day the inspections were performed.
   6. Immediately submit reports of materials or work not conforming to the requirements of the DSA approved construction documents to DSA, the Architect, structural engineer, Project Inspector and the Owner.
   7. Submit daily special inspection reports in a timely manner such that construction is not delayed and not to exceed 14 days from the date the special inspections were performed to DSA, the Architect, structural engineer, Project Inspector and the Owner.
   8. The Engineering Manager for the Laboratory of Record shall submit verified report form DSA 291 to DSA, the Project Inspector, the Owner and the Architect.
   9. The reports are required to be submitted upon any of the following events occurring:
      a. Within 14 days of the completion of the special inspection work.
      b. Work on the project is suspended for a period of more than one month.
      c. The services of the special inspector are terminated for any reason prior to completion of the project.
      d. DSA requests a verified report.
      e. The Engineering Manager for the Laboratory of Record shall submit an interim verified report to DSA and a copy to the Project Inspector for each of the applicable sections of the form DSA 152, prior to the signing off that section of the project inspection card, if that section required special inspections.

F. Duties of Special Inspectors Not Employed by the Laboratory of Record:
   1. Meet with the Project Inspector, Laboratory of Record, the design professionals, and the Contractors as needed to mutually communicate and understand the testing and inspection program, and the methods of communication appropriate for the project.
   2. Report all project related activities to the Project Inspector. The Project Inspector is responsible for monitoring the work of the Laboratory of Record and special inspectors to ensure the testing and special inspection program is satisfactorily completed.
   3. Perform work under the direction of the Architect, as defined in Section 4-335(f)1.B of the 2022 California Administrative Code (Title 24, Part 1).
   4. Perform inspections in conformance with the DSA approved construction documents, applicable codes and code reference standards.
   5. Prepare detailed daily inspection reports outlining the work inspected and provide the Project Inspector a copy of the reports on the same day the inspections were performed.
   6. Immediately submit reports of materials or work not conforming to the requirements of the DSA approved construction documents to DSA, the Architect, structural engineer, Project Inspector and the Owner.
   7. Submit daily special inspection reports in a timely manner such that construction is not delayed and not to exceed 14 days from the date the special inspections were performed to submitted to DSA, the Architect, structural engineer, Project Inspector and the Owner.
   8. Submit Special Inspection Verified Report forms DSA 292 to DSA, the project inspector, the Owner and the Architect upon any of the following events occurring:
      a. Within 14 days of the completion of the special inspection work.

b. Work on the project is suspended for a period of more than one month.
c. The services of the special inspector are terminated for any reason prior to completion of the project.
d. DSA requests a verified report.
e. Submit an interim Special Inspection Verified Report (form DSA 292) to DSA and a copy to the Project Inspector for each of the applicable sections of the form DSA 152, prior to the Project Inspector signing off that section of the project inspection card, if that section required special inspections.

G. Duties of the Architect:
1. Responsible to the Owner and to DSA to see that the completed work conforms in every material respect to the DSA approved construction documents.
2. Ensure the Project Inspector is approved by DSA for the project by submitting form DSA 5 PI to and obtaining approval from DSA prior to the start of construction, and prior to requesting issuance of form DSA 152.
3. Provide a copy of the DSA approved construction documents to the project inspector and Laboratory of Record prior to the commencement of construction.
4. Provide a copy of the DSA approved Statement of Structural Tests and Special Inspections (form DSA 103) to the Project Inspector and Laboratory of Record prior to the commencement of construction.
5. Provide general direction of the work of the Project Inspector.
6. Issue specific instructions to the testing facility and the special inspectors prior to start of construction.
7. Direct and monitor the work of special inspectors who are not provided by the Laboratory of Record, as defined in Section 4-335(f)1B of the 2022 California Administrative Code (Title 24, Part 1).
8. Notify DSA as to the disposition of materials noted on laboratory testing, and/or special inspection reports as not conforming to the DSA approved construction documents.
9. Respond to DSA Field Trip Notes (form DSA 135 or comparable) as necessary.
10. Provide observation of the construction and maintain such personal contact with the project as is necessary to assure themselves of compliance, in every material respect, with the DSA approved construction documents.
11. Submit Architect Verified Reports (form DSA 6-AE) to DSA and to the Project Inspector upon any of the following events occurring:
    a. The project is substantially complete. DSA considers the project to be complete when the construction is sufficiently complete in accordance with the DSA approved construction documents so that the Owner can occupy or utilize the project.
    b. Work on the project is suspended for a period of more than one month.
    c. The services of the Architect or engineer are terminated for any reason prior to completion of the project.
    d. DSA requests a verified report.
    e. The Architect or engineer shall submit an interim Architect Verified Report (form DSA 6-AE) to DSA and a copy to the Project Inspector for each of the applicable sections of the form DSA 152 prior to the Project Inspector signing off that section of the project inspection card.

H. Duties of the Other Responsible Design Professionals:
1. Responsible to the school board and to DSA to see that the completed work for which they are delegated responsibility conforms in every material respect to the DSA approved construction documents.
2. Provide observation of the construction and maintain such personal contact with the project as is necessary to assure themselves of compliance, in every material respect, with the DSA approved construction documents.
3. Submit an Architect/Engineer Verified Report (form DSA 6-AE) to the Architect, who in turn will submit to DSA and the project inspector, upon any of the following events occurring:
    a. The project is substantially complete. DSA considers the project to be complete when the construction is sufficiently complete in accordance with the DSA approved construction documents so that the Owner can occupy or utilize the project.

b. Work on the project is suspended for a period of more than one month.
c. The services of the Architect or engineer are terminated for any reason prior to completion of the project.
d. DSA requests a verified report.
e. The Architect shall submit to DSA and the Project Inspector an Interim Architect/Engineer Verified Report (form DSA 6-AE), signed by all Architects and engineers having delegated responsibility for each of the sections of the form DSA 152 applicable to the areas of delegated responsibility, prior to the Project Inspector signing that section off on the project inspection card.

I. Duties of Contractor:
1. The Contractor shall carefully study the DSA approved documents and shall plan a schedule of operations well ahead of time.
2. If at any time it is discovered that work is being done which is not in accordance with the DSA approved construction documents, the Contractor shall correct the work immediately.
3. Verify that DSA 152 forms were issued for the project prior to the commencement of construction.
4. Meet with the Architect, the Laboratory of Record and the Project Inspector to mutually communicate and understand the testing and inspection program, and the methods of communication appropriate for the project.
5. Notify the Project Inspector, in writing, of the commencement of construction of each and every aspect of the work at least 48 hours in advance by submitting form DSA 156, or other agreed upon written documents, to the Project Inspector.
6. Notify the Project Inspector of the completion of construction of each and every aspect of the work by submitting form DSA 156 (or other agreed upon written documents) to the Project Inspector.
7. Consider the relationship of the signed off blocks and sections of the form DSA 152 and the commencement of subsequent work.
   a. Until the Project Inspector has signed off applicable blocks and sections of the form DSA 152, the Contractor may be prohibited from proceeding with subsequent construction activities that cover up the unapproved work.
   b. Any subsequent construction activities, that cover up the unapproved work, will be subject to a "Stop Work Order" from DSA or the Owner, and are subject to removal and remediation if found to be in non-compliance with the DSA approved construction documents.
8. Submit the final Contractor Verified Reports (form DSA 6-C) to DSA and the Project Inspector upon any of the following events occurring:
   a. The project is substantially complete. DSA considers the project to be complete when the construction is sufficiently complete in accordance with the DSA approved construction documents so that the Owner can occupy or utilize the project.
   b. Work on the project is suspended for a period of more than one month.
   c. The services of the Contractor are terminated for any reason prior to the completion of the project.
   d. DSA requests a verified report.

J. Duties of the Owner:
1. Provide for competent, adequate and continuous construction inspections and material testing for the project by employing an appropriate DSA certified approved Project Inspector and Laboratory of Record.
2. Contractually provide for and ensure that the design team is fulfilling their code required duty to observe the construction by making periodic visits of reasonable frequency.
3. Ensure that the Project Inspector is approved by DSA for the project by submitting form DSA 5 to and obtaining approval from DSA prior to the start of construction and prior to requesting issuance of project inspection cards (DSA 152 forms).
4. Ensure the Laboratory of Record is LEA approved and employed prior to the start of construction and prior to requesting issuance of project inspection cards (DSA 152 forms).
5. Ensure that the project inspection cards (DSA 152 forms) are issued prior to commencement of construction.
6. Submit Statement of Final Actual Project Cost (form DSA 168) to DSA when the project is substantially

complete.

1.7 CONTRACTOR COOPERATION WITH PROJECT INSPECTOR AND DSA

A. The Inspector and DSA shall have access to the Work at all times and at all locations where the Work or parts of the Work is in progress. The Contractor shall provide facilities for such access to enable the Inspector and DSA to perform their functions properly and safely.

END OF SECTION 01 4320

SECTION 01 4520 - TESTING AND SPECIAL INSPECTION SERVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section describes testing and inspection to be provided by the Owner and cooperation required from the Contractor with the Owner's selected testing agency and others responsible for testing and inspecting the Work. For detailed testing requirements, refer to the quality control requirements of the following sections:
   1. Section 01 4320: DSA Construction Oversight.
   2. Section 03 1510: Concrete expansion anchor testing.
   3. Section 03 3000: Concrete testing and inspection.
   4. Section 04 2900: Reinforced masonry, grout, and mortar testing and inspection.
   5. Section 05 1200: Structural steel testing and inspection.
   6. Section 05 5000: Metal fabrications testing and inspection.
   7. Section 06 1100: Rough Carpentry.
   8. Section 06 1730: Wood I-joist testing and inspection.
   9. Section 06 1800: Glued-laminated timber inspection.
   10. Section 09 0560: Testing of concrete floor slabs for moisture and pH.
   11. Section 31 2000: Soils inspection and testing, import soil toxic testing.
   12. Section 32 1210: Asphaltic concrete paving testing.

B. Testing may be required per the Specification Sections noted above that is not specifically noted on Form DSA-103, Statement of Structural Tests and Special Inspections.

C. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   1. Section 01 4320: DSA construction oversight.

D. Work Not Included:
   1. Selection of testing laboratory: The Owner will select a prequalified independent testing laboratory.
   2. Payment for initial testing: The Owner will pay all services of the DSA approved testing laboratory as further described in Part 2 of this Section.

1.2 SUBMITTALS

A. Test Reports:
   1. The testing laboratory will provide test and inspection reports for all testing and inspection required by this Section and the Division of the State Architect in accordance with DSA Procedure 13-1.
   2. One copy of all test and inspection reports shall be forwarded by the testing laboratory to DSA, the Owner, the Architect, the Engineer, the Inspector, and the Contractor.
   3. Reports shall include all tests made regardless of whether such tests indicate that the material is satisfactory or unsatisfactory.
   4. Samples taken but not tested shall also be reported.
   5. Reports shall indicate that the material or materials were sampled and tested in accordance with the requirements of Title 24, California Code of Regulations, and the Contract Documents.
   6. Reports shall indicate the specified design strength and state definitely whether or not the material or materials tested comply with the requirements.

B. Contractor's Statement of Responsibility: In accordance with CBC Section 1704A.4, Contractor shall submit a statement of responsibility to the Architect, the Owner, and DSA prior to the commencement of work of the main wind or seismic force resisting systems or component. Statement of responsibility shall contain

acknowledgment of awareness of the special inspection requirements contained in the statement of special inspections.

C. Verified Reports: The testing laboratory will provide interim and final verified reports in accordance with Section 01 4320 and DSA Procedure PR 13-1.

1.3 QUALITY ASSURANCE

A. The Owner will select an independent testing laboratory to conduct tests. Testing laboratory shall be approved by the Architect, Structural Engineer, and the Division of the State Architect.

B. Selection of material required for testing shall be by the laboratory or the Owner's representative and not by the Contractor.

C. Testing, when required, will be in accordance with all pertinent codes and regulations, and with selected standards of the American Society for Testing and Materials.

D. Division of the State Architect Testing & Inspection: At a minimum, the testing required for the project is indicated in the Form DSA-103, Statement of Structural Tests and Special Inspections attached at the end of this Section.
   1. Where no testing requirements are described, but the Owner or DSA decides that testing is required, the Owner or DSA may require such testing to be performed under current pertinent standards for testing. Payment for such testing will be made as described in this Section.
   2. Testing may be required by other Specification Sections that is not specifically noted on Form DSA-103, Statement of Structural Tests and Special Inspections.

1.4 MATERIALS, TESTING, AND INSPECTION STANDARDS

A. Comply with the California Building Code, 2022 Edition.

B. Concrete - Section 03 3000:
   1. Material Standards:
      a. Portland cement: CBC Section 1903A.1, ACI 318, Table 26.4.1.1.1(a).
      b. Fly ash: ACI 318, Table 26.4.1.1.1(a).
      c. Concrete aggregates: CBC Section 1903A.5; ACI 318, Section 26.4.1.2.1(a)(1).
   2. Material Tests:
      a. Reinforcing bar test: CBC Section 1910A.2.
      b. Waiver of reinforcing bar testing: CBC Section 1910A.2.
      c. Concrete strength: ACI 318, Section 26.12.
      d. Drilled expansion / epoxy bolt: CBC Section 1910A.5.
      e. Composite construction cores: CBC Section 1910A.4.
   3. Special Inspections:
      a. Job site inspection: CBC Section 1704A.3, Table 1705A.3.
      b. Batch plant inspection: CBC Section 1705A.3.3.
      c. Waiver of batch plant inspection: CBC Section 1705A.3.3.1.
      d. Post-installed anchors: CBC Table 1705A.3, Type 4, Section 1910A.5.

C. NOT USED

D. Reinforced Unit Masonry - Section 04 2900:
   1. Material Standards:
      a. Concrete masonry units: CBC Section 2103A.1.
      b. Mortar: CBC Section 2103A.2.

c. Grout: CBC Section 2103A.3.
d. Reinforcement and accessories: CBC Section 2103A. 4.
e. Additives and admixtures: CBC 2103A.5.

2. Material Tests:
   a. Concrete masonry: CBC 2105A.2.
   b. Mortar and grout: CBC Section 2105A.3.
   c. Masonry core test: CBC Section 2105A.4.
   d. Reinforcing bar: CBC Section 1910A.2.
3. Special Inspections:
   a. TMS402/ACI 530/ASCE 5, Table 3.1.1 Level C requirements.
   b. TMS 602/ACI 530/ASCE 6.
   c. Post-installed anchors: CBC Sections 1705A.4 and 1910A.5.

E. NOT USED

F. NOT USED

G. Structural Steel - Section 05 1200:
1. Material Standards:
   a. Structural steel: CBC Sections 2203A.1.
   b. Material identification: CBC Section 2203A.1 and AISC 360-16 Section A3.1.
2. Material Tests:
   a. Structural steel: CBC Section 2203A.1.
   b. High strength bolts, nuts, washers: CBC Section 2213A.1.
   c. End welded studs: CBC Section 2213A.2.
3. Special Inspection: CBC Table 1705A.2.1.
   a. Shop fabrication: CBC Section 1705A.2.1.
   b. Welding: CBC Section 1705A.2.5, Table 1705A.2.1.
   c. Steel frame special inspection: CBC Table 1705A.2.1.
   d. End welded stud welding: CBC Table 1705A.2.1.
   e. High strength bolts: CBC Table 1705A.2.1.

H. NOT USED

I. Wood - Section 06 1100:
1. Material Standards:
   a. Sawn Lumber Material Standards: CBC Section 2303.1.1.
   b. Plywood Material Standards: CBC Section 2303.1.5.
   c. Structural Composite Lumber Material Standards: CBC Sections 2303.1.4 and 2303.1.3.1.
2. Prefabricated (off-site built) wall framing.
   a. Testing and Inspection: Refer to Section 06 1100.

J. Prefabricated Wood I-Joists - Section 06 1730:
1. Material Standards: CBC Section 2303.1.2.
2. Fabrication Special Inspection: ASTM D5055, Sections 8, 9, and 10.

K. Structural Glued-Laminated Timber - Section 06 1800:
1. Materials Standards: CBC Section 2303.1.3.
2. Fabrication Special Inspection: CBC Section 1705A.5.4.

M. NOT USED

N. NOT USED

O. Moisture Control Treatment Testing:
   1. Testing and Inspection: Refer to Section 09 0650.

P. NOT USED

Q. Earth Fill, Foundations, and Excavations - Section 31 2000:
   1. Special Inspection:
      a. Fill and Compaction: CBC Section 1705A.6 and Table 1705A.6.
      b. Pier Foundations: CBC Section 1704A.8.

R. Toxic Testing of Import Fill Material - Section 31 2000:
   1. Testing and Inspection: Refer to Section 31 2000.

S. Subsoils Improvement:
   1. Special Inspection:
      a. Lime Soil Stabilization: Refer to Section 31 3215.
      b. Compaction Grouting Special Inspections: Refer to Section 31 4300.
      c. Vibro-replacement Special Inspections: Refer to Section 31 4510.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Promptly process and distribute required copies of test reports and related instructions to assure necessary re-testing and replacement of materials with the least possible delay in progress of the Work.

PART 2 - PRODUCTS

2.1 PAYMENT FOR TESTING

A. Initial Testing: The Owner will pay for services requested by the Owner.

B. Retesting: When initial tests indicate non-compliance with the Contract Documents, subsequent retesting occasioned by the non-compliance shall be performed by the same testing agency and the costs thereof will be paid by the Contractor.

2.2 CONTRACTOR'S CONVENIENCE TESTING

A. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

2.3 OWNER’S INSPECTOR

A. The Owner shall employ a DSA approved Inspector in accordance with the requirements of the California Code of Regulations, Title 24. The Inspector’s duties are specifically defined in Title 24, Part 1, Section 4-342.
   1. Refer to Section 01 4320 - DSA Construction Oversight.

B. The work of construction in all stages of progress shall be subject to the personal continuous inspection of the Inspector. The Inspector shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Inspector reasonable facilities for obtaining such information as may be necessary to keep the Inspector fully informed respecting the progress and manner of the work and character of the materials. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract.

PART 3 - EXECUTION

3.1 COOPERATION WITH TESTING LABORATORY

A. Representatives of the Owner and the testing laboratory shall have access to the Work at all times and at all locations where the Work or parts of the Work is in progress. The Contractor shall facilities for such access to enable the laboratory to perform its functions properly and safely.

3.2 TAKING SPECIMENS

A. Test specimens and prisms required for concrete, grout and mortar shall be taken by the testing laboratory and delivered directly to the testing laboratory as required by the California Building Code, 2022 Edition.

B. The testing laboratory shall be responsible for testing the samples.

C. Miscellaneous materials to be tested shall be tagged by the Project Inspector and delivered to the testing laboratory for testing. The testing laboratory shall provide specimen containers for the Project Inspector for the required tests.

3.3 SCHEDULES FOR TESTING

A. Establishing Schedule:
   1. The Contractor shall notify the Project Inspector a sufficient time in advance of the manufacture of material to be supplied under the Contract Documents, which must by terms of the Contract be tested, in order that the Inspector may arrange for testing of the material at the source of supply.
   2. The Contractor shall provide time within the construction schedule required for the laboratory to perform its tests and to issue each of its findings.
   3. Contractor shall coordinate times for testing of materials and/or installations with the testing laboratory not less than 48 hours prior to the need for testing.

B. Revising Schedule: When changes of construction schedule are necessary during construction, coordinate all such changes with the testing laboratory as required.

C. Adherence to Schedule: When the testing laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra charges for testing attributable to the delay may be back charged to the Contractor and shall not be borne by the Owner.

D. Tests and Inspections Required:
   1. Refer to attached Form DSA 103.
   2. Testing may be required by other Specification Sections that is not specifically noted on Form DSA-103, Statement of Structural Tests and Special Inspections.

3.4 UNTESTED MATERIALS

A. Any material shipped by the Contractor from the source of supply prior to having satisfactorily passed any required testing and inspection, or prior to receipt of notice from the Architect that testing and inspection will not be required, shall not be incorporated into the Work.

B. If such non-inspected and non-tested material is incorporated into the project, it shall be removed at the Contractor’s expense and no consideration will be given for delays or additional cost caused by this action.

END OF SECTION 01 4520

DSA

103-22

LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

☑ Project has a geotechnical report or construction documents require special inspection by a geotechnical engineer.
☐ Project does NOT have and does NOT require a geotechnical report.

	TYPE	BY
S1 | SOILS - GENERAL		
☑ S1a: Site Preparation	Periodic	GE
S2 | COMPACTION AND FILL		
☑ S2a: Fill Materials	Test	LOR*
☑ S2b: Fill Placement	Continuous	GE*
☑ S2c: Compaction	Test	LOR*
S3 | DRIVEN DEEP FOUNDATIONS (PILES)		
☐ S3a: Materials and Members	Continuous	GE*
☐ S3b: Pile Capacity	Test	LOR*
☐ S3c: Driving Operations	Continuous	GE*
☐ S3d: Pile Installation	Continuous	GE*
☐ S3e: Specialty Piles	*	*
S4 | CAST-IN-PLACE DEEP FOUNDATIONS (PIERS)		
☑ S4a: Drilling Operations	Continuous	GE*
☑ S4b: Pier Construction	Continuous	GE*
☑ S4c: Bearing Strata	Continuous	GE*
S5 | RETAINING WALLS		
☐ S5a: Backfill Placement	Continuous	GE*
☐ S5b: Soil Reinf. and Drainage	Continuous	GE*
☐ S5c: Segmental Retaining Walls	Continuous	GE*
S6 | OTHER SOILS		
☐ S6a: Soil Improvement Test	Test	GE*
☐ S6b: Soil Improvement Inspection	Continuous	GE*
☐ S6c: Not used.	N/A	N/A
☐ S6d: Not used.	N/A	N/A
☐ S6e: Not used.	N/A	N/A
☐ S6f: Not used.	N/A	N/A
☐ S6g: Not used.	N/A	N/A
☐ S6h: Not used.	N/A	N/A
☐ S6i: Not used.	N/A	N/A
☐ S6j: Not used.	N/A	N/A
☐ S6k: Not used.	N/A	N/A
☐ S6l: Not used.	N/A	N/A
☐ S6m: Not used.	N/A	N/A
☐ S6n: Not used.	N/A	N/A

* See Appendix for additional information.

	TYPE	BY
C1 | CAST-IN-PLACE CONCRETE		
☑ C1a: Mix Design	Continuous	SI
☑ C1b: Reinforcing Steel	Test	LOR
☑ C1c: Concrete Material	Test	LOR
☑ C1d: Strength Test	Test	LOR
☑ C1e: Batch Plant Inspection	Continuous	SI
C2 | PRESTRESSED CONCRETE		
☐ C2a: Tendons and Anchorage	Test	LOR
☐ C2b: Tendon Placement	Periodic	SI
☐ C2c: Concrete Strength	Periodic	SI
☐ C2d: Stressing Operations	Continuous	SI
C3 | PRECAST CONCRETE		
☐ C3a: General Fabrication	Continuous	SI
☐ C3b: General Erection	Periodic	SI*
☐ C3c: Diaphragm Connections	Continuous	SI
☐ C3d: Diaphragm Tolerances	Periodic	SI
C4 | SHOTCRETE		
☐ C4a: Placement	Continuous	SI
☐ C4b: Shotcrete Material	Test	LOR
C5 | POST-INSTALLED ANCHORS		
☑ C5a: Inspection	See notes	SI*
☑ C5b: Test	Test	LOR
C6 | OTHER CONCRETE		
☐ C6a: Not used.	N/A	N/A
☐ C6b: Not used.	N/A	N/A
☐ C6c: Not used.	N/A	N/A
☐ C6d: Not used.	N/A	N/A
☐ C6e: Not used.	N/A	N/A
☐ C6f: Not used.	N/A	N/A
☐ C6g: Not used.	N/A	N/A
☐ C6h: Not used.	N/A	N/A
☐ C6i: Not used.	N/A	N/A
☐ C6k: Not used.	N/A	N/A
☐ C6l: Not used.		
Not used.		

* See Appendix for additional information.

Project Name: **NEW TEMPERANCE ELEMENTARY SCHOOL** Application No.: **02-123774** Increment:
School District: **SANGER UNIFIED SCHOOL DISTRICT** File No.: **10-126**

LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

	TYPE	BY
M1 | STRUCTURAL MASONRY f'm PSI: 2000		
☑ M1a: Mill Certificates - Reinf.	Periodic	SI*
☑ M1b: Material Certificates	Test	LOR
☑ M1c: Strength Test	Test	LOR
☑ M1d: Mortar Proportions	Periodic	SI
☑ M1e: Grout Proportions	Periodic	SI
☑ M1f: Batch Plant Inspection	Continuous	SI
☑ M1g: Core Tests	Test	LOR
☐ M1h: Prisms	Continuous	SI
☑ M1i: Dowels and Supports	Periodic	SI
☑ M1j: Reinforcement and Members	Periodic	SI
☑ M1k: Reinforcement Placement	Continuous	SI
☑ M1l: Grout Placement	Continsuous	SI
☑ M1m: Unit Layup and Joints	Periodic	SI*
☑ M1n: Cold/Hot Weather Work	Periodic	SI
☑ M1o: Anchors and Embeds	Continuous	SI
☑ M1p: Grout Cavity	Continuous	SI
M2 | VENEER OR GLASS BLOCK PARTITIONS		
☐ M2a: Mortar and Grout	Periodic	SI
☐ M2b: Unit Layup and Joints	Periodic	SI
☐ M2c: Wires and Connector	Periodic	SI
☐ M2d: Anchors and Embeds	Periodic	SI
☐ M2e: Cold/Hot Weather Work	Periodic	SI*
☐ M2f: Adhered Veneer Bond	Test	LOR
M3 | POST-INSTALLED ANCHORS		
☑ M3a: Inspection	Varies*	SI*
☑ M3b: Test	Test	LOR
M4 | OTHER MASONRY		
☐ M4a: Not used.	N/A	N/A
☐ M4b: Not used.	N/A	N/A
☐ M4c: Not used.	N/A	N/A
☐ M4d: Not used.	N/A	N/A
☐ M4e: Not used.	N/A	N/A
☐ M4f: Not used.	N/A	N/A
☐ M4g: Not used.	N/A	N/A
☐ M4h: Not used.	N/A	N/A
☐ M4i: Not used.	N/A	N/A
☐ M4j: Not used.	N/A	N/A
☐ M4k: Not used.		
☐ M4l: Not used.		
☐ M4m: Not used.		
* See Appendix for additional information.		

	TYPE	BY
S/A1 | STEEL AND ALUMINUM		
☑ S/A1a: Material Identification	Periodic	*
☑ S/A1b: Unidentified Material	Test	LOR
☑ S/A1c: Steel Fabrication	Periodic	SI
☐ S/A1d: Buckling Restrained Brace	Test*	LOR
S/A2 | HIGH-STRENGTH BOLTS		
☑ S/A2a: Product Verification	Periodic	SI
☑ S/A2b: Bolts, Nuts, and Washers	Test	LOR
☑ S/A2c: Snug Tight	Periodic	SI
☑ S/A2d: Pretensioned / Slip-Critical	*	SI
S/A3 | WELDING		
☑ S/A3a: Weld Material	Periodic	SI
☑ S/A3b: Certificate of Compliance	Periodic	SI
☑ S/A3c: WPS and Qualifications	Periodic	SI
S/A4 | SHOP WELDING		
☑ S/A4a: Weld Category A	Continuous	SI
☑ S/A4b: Weld Category B	Periodic	SI
☐ S/A4c: Stairs and Railing	Periodic	SI
☐ S/A4d: Reinf. Steel Weldability	Periodic	SI
☐ S/A4e: Reinforcing Steel	Continuous	SI
S/A5 | FIELD WELDING		
☑ S/A5a: Weld Category A	Continuous	SI
☑ S/A5b: Weld Category B	Periodic	SI
☐ S/A5c: End Welded Studs	Periodic	SI
☐ S/A5d: Deck Welds	Periodic	SI
☐ S/A5e: Cold-Formed Steel	Periodic	SI
☐ S/A5f: Stairs and Railing	Periodic	SI
☐ S/A5g: Reinf. Steel Weldability	Periodic	SI
☐ S/A5h: Reinforcing Steel	Continuous	SI
S/A6 | NONDESTRUCTIVE TESTING		
☐ S/A6a: Ultrasonic	Test	LOR
☐ S/A6b: Magnetic Particle	Test	LOR
☐ S/A6c:Not used.	N/A	N/A
☐ S/A6d:Not used.	N/A	N/A
☐ S/A6e:Not used.	N/A	N/A
S/A7 | STEEL JOISTS AND TRUSSES		
☐ S/A7a: Fabrication	Continuous	SI
S/A8 | SPRAYED FIRE-RESISTANT MATERIALS		
☐ S/A8a: Surface and Installation	Periodic	SI
☐ S/A8b: Density	Test	LOR
☐ S/A8c: Bond: Adhesion/Cohesion	Test	LOR
* See Appendix for additional information.		

Project Name: **NEW TEMPERANCE ELEMENTARY SCHOOL** Application No.: **02-123774** Increment:
School District: **SANGER UNIFIED SCHOOL DISTRICT** File No.: **10-126**

LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

	TYPE	BY
S/A9 | ANCHOR BOLTS AND ANCHOR RODS		
☑ S/A9a: Anchor Rods and Bolts	Test	LOR
☐ S/A9b: Other Threaded Rods	Test	LOR
S/A10 | STORAGE RACK SYSTEMS		
☐ S/A10a: Material Verification	Periodic	SI
☐ S/A10b: Fabrication	Periodic	SI
☐ S/A10c: Anchorage	Periodic	SI
☐ S/A10d: Completed System	Periodic	SI*
S/A11 | OTHER STEEL AND ALUMINUM		
☐ S/A11a: Not used.	N/A	N/A
☐ S/A11b: Not used.	N/A	N/A
☐ S/A11c: Not used.	N/A	N/A
☐ S/A11d: Not used.	N/A	N/A
☐ S/A11e: Not used.	N/A	N/A
☐ S/A11f: Not used.	N/A	N/A
☐ S/A11g: Not used.	N/A	N/A
☐ S/A11h: Not used.	N/A	N/A
☐ S/A11i: Not used.	N/A	N/A
☐ S/A11j: Not used.	N/A	N/A
W1 | PREFABRICATED WOOD TRUSSES		
☐ W1a: Open Web Truss Fabrication	Continuous	SI
☐ W1b: Metal Plate Truss Fabrication	Continuous	SI
W2 | MANUFACTURED WOOD ELEMENTS		
☑ W2a: GL Timber Fabrication	Continuous	SI
☐ W2b: CLT Fabrication	Continuous	SI
☐ W2c: Mass Timber Erection	Periodic	SI
☐ W2d: Connections Type A	Periodic	SI
☐ W2e: Connections Type B	Continuous	SI
☐ W2f: Sealants	Periodic	SI
W3 | OTHER WOOD		
☐ W3a: Not used.	N/A	N/A
☐ W3b: Not used.	N/A	N/A
☐ W3c: Not used.	N/A	N/A
☐ W3d: Not used.	N/A	N/A
☐ W3e: Not used.	N/A	N/A
☐ W3f: Not used.	N/A	N/A
☐ W3g: Not used.	N/A	N/A
☐ W3h: Not used.	N/A	N/A

* See Appendix for additional information.

	TYPE	BY
X | OTHER		
☑ X01: Product Load Test*	Test	LOR
☑ X02: Non-HSB Installation Torque	Continuous	SI*
☑ X03: Solar Panel	Continuous	PI
☑ X04: Solar Panel	Continuous	PI
☐ X05: Not used.	N/A	N/A
☐ X06: Not used.	N/A	N/A
☐ X07: Not used.	N/A	N/A
☐ X08: Not used.	N/A	N/A
☐ X09: Not used.	N/A	N/A
☐ X10: Not used.	N/A	N/A

EXEMPTIONS

Those items identified on the DSA-approved construction documents with a note indicating they are not part of the DSA approval or those items checked below are exempt from test and special inspection requirements. The project inspector shall verify all construction complies with the approved construction documents.

- ☐ Soils: Eligible shallow foundation elements**.
- ☐ Soils: Eligible deep foundation elements - type 1**.
- ☐ Soils: Eligible deep foundation elements - type 2**.
- ☐ Concrete/Masonry: Eligible post-installed anchors**.
- ☐ Concrete: Batch plant inspection for items listed in and complying with CBC Section 1705A.3.3.2.
- ☐ Concrete: Epoxy shear dowels in nonstructural slab-on-grade per CBC Section 1910A.5.4, Exception #4.
- ☐ Concrete/Masonry: Reinforcing bar testing for items listed in and complying with CBC Section 1910A.2.
- ☐ Masonry: Freestanding site walls and retaining walls per DSA IR 21-1.
- ☐ Concrete: Eligible precast elements**.
- ☐ Welding: Eligible fences and gates**.
- ☑ Welding: Eligible railing and ramps**.
- ☐ Welding: Eligible interior cold-formed steel framing**.
- ☑ Welding: Eligible equipment curbs**.
- ☑ Welding: Eligible components supporting MEP distribution systems**.
- ☑ Welding: Eligible mounts and recreational equipment**.
- ☐ Welding: Eligible nonstructural components**.

** See Appendix for eligibility requirements.

Project Name: **NEW TEMPERANCE ELEMENTARY SCHOOL** Application No.: **02-123774** Increment:
School District: **SANGER UNIFIED SCHOOL DISTRICT** File No.: **10-126**

LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

IMPORTANT: This form is only a summary list of structural tests and some of the special inspections required for the project. Any items indicated on the approved construction documents with a note stating that the items are not part of the DSA approval are not considered in this form. Generally, the structural tests and special inspections noted on this form are those that will be performed by the Geotechnical Engineer of Record, Laboratory of Record, or Special Inspector. The actual complete test and inspection program must be performed as detailed on the DSA approved documents. The exemption appendix at the end of this form identifies work NOT subject to DSA requirements for special inspection or structural testing. The project inspector is responsible for providing inspection of all facets of construction, including but not limited to, special inspections not listed on this form such as structural wood framing, high-load wood diaphragms, cold-formed steel framing, anchorage of nonstructural components, etc., per Title 24, Part 2, Chapter 17A.

Legend to TYPE and BY Columns:

Continuous - Indicates continuous special inspection is required.

Periodic - Indicates periodic special inspection is required.

Test - Indicates a test is required.

GE – Indicates special inspection shall be performed by a registered geotechnical engineer or his/her authorized representative, usually associated with the Laboratory of Record.

LOR – Indicates test or special inspection shall be performed by a testing laboratory accepted in the DSA Laboratory Evaluation and Acceptance (LEA) Program (i.e., the Laboratory of Record for the project). See CAC Section 4-335.

PI - Indicates special inspection may be performed by a project inspector when specifically approved by DSA.

SI - Indicates special inspection shall be performed by an appropriately qualified/approved special inspector.

Required Verified Reports:

1. Soils Testing and Inspection: Form DSA 293
2. Structural Testing and Inspection: Form DSA 291
3. Concrete Batch Plant Inspection: Form DSA 291
4. Post-installed Anchors: Form DSA 291 or DSA 292
5. Masonry Inspection: Form DSA 291 or DSA 292
6. Shop Welding Inspection: Form DSA 291 or DSA 292
7. Field Welding Inspection: Form DSA 291 or Form DSA 292
8. High-Strength Bolting Inspection: Form DSA 291 or DSA 292
9. Mass Timber Inspection: Form DSA 291 or DSA 292
10. Non-High-Strength Bolt Inspection: Form DSA 291 or Form DSA 292.

Verified reports are required on the following DSA forms:

DSA 291: Laboratory of Record Verified Report

DSA 292: Special Inspectors Employed Directly by the District Verified Report

DSA 293: Geotechnical Verified Report

Note: To facilitate DSA electronic mark-ups and identification stamp application, DSA recommends against using secured electronic or digital signatures.

Name of Design Professional in General Responsible Charge:

J. Ryan Morrelli

Name of Structural Engineer of Record (when applicable):

Signature of Architect or Structural Engineer: **Date:**

12.15.2025

DSA STAMP

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 02-123774 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 09/22/26

Project Name: **NEW TEMPERANCE ELEMENTARY SCHOOL**
School District: **SANGER UNIFIED SCHOOL DISTRICT**

Application No.: **02-123774** Increment:
File No.: **10-126**

Appendix: LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

NOTE: Undefined sections and table references found in this appendix are from the CBC, or California Building Code

S1. GENERAL:	
Test or Special Inspection	**Code References and Notes**
S1a: Site Preparation | Verify that: • Site has been prepared properly prior to placement of controlled fill and/or excavations for foundations. • Foundation excavations are extended to proper depth and have reached proper material. • Materials below footings are adequate to achieve the design bearing capacity.	* By geotechnical engineer or his or her qualified representative. (See Appendix (end of this form) form for exemptions.)

S2. SOIL COMPACTION AND FILL:	
Test or Special Inspection	**Code References and Notes**
S2a: Fill Materials | Perform classification and testing of fill materials.	* Under the supervision of the geotechnical engineer.
S2b: Fill Placement | Verify use of proper materials, densities and inspect lift thicknesses, placement and compaction during placement of fill.	* By geotechnical engineer or his or her qualified representative. (Refer to specific items identified in the Appendix (end of this form) form for exemptions where soils SI and testing may be conducted under the supervision of a geotechnical engineer or LOR's engineering manager. In such cases, the LOR's form DSA 291 shall satisfy the soil SI and test reporting requirements for the exempt items.)
S2c: Compaction | Compaction testing.	* Under the supervision of the geotechnical engineer. (Refer to specific items identified in the Appendix (end of this form) for exemptions where soils testing may be conducted under the supervision of a geotechnical engineer or LOR's engineering manager. In such cases, the LOR's form DSA 291 shall satisfy the soil test reporting requirements for the exempt items.)

S3. DRIVEN DEEP FOUNDATIONS (PILES):	
Test or Special Inspection	**Code References and Notes**
S3a: Materials and Members | Verify pile materials, sizes and lengths comply with the requirements.	* By geotechnical engineer or his or her qualified representative.
S3b: Pile Capacity | Determine capacities of test piles and conduct additional load tests as required.	* Under the supervision of the geotechnical engineer.
S3c: Driving Operations | Inspect driving operations and maintain complete and accurate records for each pile.	* By geotechnical engineer or his or her qualified representative.

S3d: Pile Installation | Verify locations of piles and their plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and record any pile damage.	* By geotechnical engineer or his or her qualified representative.
S3e: Specialty Piles | For specialty piles, perform additional inspections as determined by the registered design professional in responsible charge.	* As defined on drawings or specifications.

S4. CAST-IN-PLACE DEEP FOUNDATIONS (PIERS):	
Test or Special Inspection	**Code References and Note**
S4a: Drilling Operations | Inspect drilling operations and maintain complete and accurate records for each pier.	* By geotechnical engineer or his or her qualified representative. (See Appendix (end of this form) for exemptions.)
S4b: Pier Construction | Verify pier locations, diameters, plumbness, bell diameters (if applicable), lengths and embedment into bedrock (if applicable); record concrete or grout volumes.	* By geotechnical engineer or his or her qualified representative. (See Appendix (end of this form) for exemptions.)
S4c: Bearing Strata | Confirm adequate end strata bearing capacity.	* By geotechnical engineer or his or her qualified representative. (See Appendix (end of this form) for exemptions.)

S5. RETAINING WALLS:	
Test or Special Inspection	**Code References and Notes**
S5a: Backfill Placement | Placement, compaction and inspection of backfill.	1705A.6.1. * By geotechnical engineer or his or her qualified representative. (See section S2 above).
S5b: Soil Reinf. and Drainage | Placement of soil reinforcement and/or drainage devices.	* By geotechnical engineer or his or her qualified representative.
S5c: Segmental Retaining Walls | Segmental retaining walls; inspect placement of units, dowels, connectors, etc.	* By geotechnical engineer or his or her qualified representative. See DSA IR 18-2.

S6 | OTHER SOILS	
Test or Special Inspection	**Code References and Notes**
S6a | Soil Improvements	Submit a comprehensive report documenting final soil improvements constructed, construction observation and the results of the confirmation testing and analysis to CGS (California Geological Survey) for final acceptance. * By geotechnical engineer or his or her qualified representative.
S6b | Inspection of Soil Improvements	* By geotechnical engineer or his or her qualified representative.
S6c. | Not used.	N/A
S6d. | Not used.	N/A
S6e. | Not used.	N/A
S6f. | Not used.	N/A
S6g. | Not used.	N/A
S6h. | Not used.	N/A
S6i. | Not used.	N/A
S6j. | Not used.	N/A
S6k. | Not used.	N/A
S6l. | Not used.	N/A
S6m. | Not used.	N/A
S6n. | Not used.	N/A

C1. CAST-IN-PLACE CONCRETE	
Test or Special Inspection	**Code References and Notes**
C1a: Mix Design | Verify use of required design mix.	**Table 1705A.3 Item 5, 1903A.5, 1903A.7, 1904A.1, 1904A.2, 1910A.1 ; ACI 318 Ch. 19, 26.4, 26.13.3.2.**
C1b: Reinforcing Steel | Identify, sample, and test reinforcing steel.	**Table 1705A.3 Item 1, 1705A.3.9, 1908A.1, 1910A.2; ACI 318 Ch. 20 and Sections 25.2, 25.3, 25.5.1, 26.6.1; DSA IR 17-10 and BU 24-02. (See Appendix (end of this form) for exemptions.)**
C1c: Concrete Material | During concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	**Table 1705A.3 Item 6, 1705A.3.9, 1905A.1.17; ASTM C31, ASTM C172; ACI 318 Sections 26.4, 26.5 & 26.12.**
C1d: Strength Test | Test concrete (f'c).	**1905A.1.17; ACI 318 Section 26.12.**
C1e: Batch Plant Inspection | Batch plant inspection: Continuous	**Default of "Continuous" per 1705A.3.3. If approved by DSA, batch plant inspection may be reduced to "Periodic" subject to requirements in Section 1705A.3.3.1, or not required per 1705A.3.3.2. See IR 17-13. (See Appendix (end of this form) for exemptions.)**

C2. PRESTRESSED / POST-TENSIONED CONCRETE (IN ADDITION TO SECTION C1):	
Test or Special Inspection	**Code References and Notes**
C2a: Tendons and Anchorage | Sample and test prestressing tendons and anchorages.	**1705A.3.4 Table 1705A.3 Item 1, 1910A.3; ACI 318 Ch. 20 and Sections 25.2, 26.6.1.**
C2b: Tendon Placement | Inspect placement of prestressing tendons.	**1705A.3.4, Table 1705A.3 Items 1 & 9; ACI 318 Ch. 20 and Sections 25.2, 26.6.1-26.6.3.**
C2c: Concrete Strength | Verify in-situ concrete strength prior to stressing of post-tensioning tendons.	**Table 1705A.3 Item 13; ACI 318 Sections 26.10.2, 26.11.2, 26.13.3.3. Special inspector to verify specified concrete strength test prior to stressing.**
C2d: Stressing Operations | Inspect application of post-tensioning or prestressing forces and grouting of bonded prestressing tendons.	**1705A.3.4, Table 1705A.3 Item 9; ACI 318 Sections 26.10.2, 26.13.1, 26.13.3.2.**

C3. PRECAST CONCRETE (IN ADDITION TO SECTION C1):	
Test or Special Inspection	**Code References and Notes**
C3a: General Fabrication | 1. Inspect fabrication of precast concrete members. * 2. Inspect reinforcement of the following precast concrete elements or system(s): a. special moment frames. b. boundary elements of special structural walls. c. coupling beams.	**1705A.3 Item 1, 7.** See Appendix for exemptions. *May be periodic where fabrication occurs in a PCI-certified plant. For underground structures, NPCA plant certification is acceptable. PCI MNL-116-21; PCI MNL-117-13; NPCA Quality Control Manual (QCM) 17th Edition. See IR A-15.

C3b: General Erection | Inspect erection of precast concrete members.	**Table 1705A.3 Item 10**.
C3c: Diaphragm Connections | For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category D, E or F, inspect such connections and reinforcement in the field for: 1. Installation of the embedded parts. 2. Completion of the continuity of reinforcement across joints. 3. Completion of connections in the field.	**Table 1705A.3 Item 11**.
C3d: Diaphragm Tolerances | Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5.	**Table 1705A.3 Item 12**

C4. SHOTCRETE (IN ADDITION TO SECTION C1):	
Test or Special Inspection	**Code References and Notes**
C4a: Placement | Inspect shotcrete placement for proper application techniques.	**1705A.3.9, Table 1705A.3 Item 7, 1908A.1, 1908A.2, 1908A.3. See ACI 506.2 Section 3.4, and ACI 506R.**
C4b: Shotcrete Material | Sample and test shotcrete (f'_c).	**1908A.2 and 1705A.3.9.**

C5. POST-INSTALLED ANCHORS:	
Test or Special Inspection	**Code References and Notes**
C5a: Inspection | Inspect installation of post-installed anchors	**1617A.1.19, Table 1705A.3 Item 4a (Continuous) & 4b (Periodic), 1705A.3.8** (See Appendix (end of this form) for exemptions). ACI 318 Sections 26.7.2, 26.13.1, 26.13.3.2, 26.13.3.3. * May be performed by the project inspector when specifically approved by DSA.
C5b: Test | Test post-installed anchors.	**1910A.5.** (See Appendix (end of this form) for exemptions.)

C6. OTHER CONCRETE:	
Test or Special Inspection	**Code References and Notes**
C6a. | Not used.	N/A
C6b. | Not used.	N/A
C6c. | Not used.	N/A
C6d. | Not used.	N/A
C6e. | Not used.	N/A
C6f. | Not used.	N/A
C6g. | Not used.	N/A
C6h. | Not used.	N/A
C6i. | Not used.	N/A
C6j. | Not used.	N/A
C6k. | Not used.	Not used.
C6l. | Not used.	Not used.

Appendix: LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

M1. STRUCTURAL MASONRY:	
Test or Special Inspection	**Code References and Notes**
M1a: Mill Certificates - Reinf. | Mill certificate indicates compliance with requirements for reinforcement, anchors, ties, fasteners and metal accessories. See item C1(b) for identification, sampling and testing of reinforcing steel.	**2103A.4**; TMS 602-16 Article 1.5B.2 & 2.4. * To be performed by qualified LOR representative. Applicable testing by LOR. See IR 17-10 for unidentified reinforcing steel.
M1b: Material Certificates | Producer's certificate of compliance for masonry units, mortar and grout materials.	**1705A.4, 2103A.2, 2103A.3, 2103A.5;** TMS 602 Articles 1.5B.2, 2.1, 2.2, 2.6A and 2.6B, and Table 6 footnote 3.
M1c: Strength Test | Test masonry (f'm).	**1705A.4. For Unit Strength: 2105A.3**; TMS 602 Articles 1.4B.2 ,1.5B.1 & 1.5B.2. **For Prism (required when f'_m > 2000 psi):2105A.2;** TMS 602 Articles 1.4B.3, 1.4B.4, 1.5B.1 & 1.5B.2.
M1d: Mortar Proportions | Verify proportions or properties of site-prepared, premixed or preblended mortar.	TMS 602, Table 3 (row 5), Table 4 Item 1a. DSA PR 20-01. (See Appendix (end of this form) for exemptions.)
M1e: Grout Proportions | Verify proportions or properties of site-prepared, premixed or preblended grout.	TMS 602, Table 3 (row 5), Table 4 Item 2d. (See Appendix (end of this form) for exemptions.)
M1f: Batch Plant Inspection | Batch plant inspection: Periodic	Default of **'Continuous'** per **1705A.3.3**. If approved by DSA, batch plant inspection may be reduced to **'Periodic'** subject to requirements in Section **1705A.3.3.1,** or not required per **1705A.3.3.2.** See IR 17-13. Refer to TMS 602 Table 3 and Table 4, Item #3a. (See Appendix (end of this form) for exemptions.)
M1g: Core Tests | Test core-drilled samples.	**2105A.4**. (See Appendix (end of this form) for exemptions.)
M1h: Prisms | Inspect preparation of prisms.	TMS 602 Articles 1.4.B.3 & 1.4.B.4 & Table 4 Item 4.
M1i: Dowels and Supports | Verify size, location and condition of all dowels, construction supporting masonry, etc.	
M1j: Reinforcement and Members | Verify size, grade and type of reinforcement, connectors, and anchor bolts. Verify size and location of structural members.	TMS 602 Table 4, Items 1c & 3c.
M1k: Reinforcement Placement | Inspect placement of reinforcement, anchor bolts, and connectors.	TMS 602 Table 4 Item 2c.
M1l: Grout Placement | Placement, consolidation, and reconsolidation of grout.	TMS 602 Table 4 Item 3h.
M1m: Unit Layup and Joints | Inspect placement of masonry units and construction of mortar joints.	TMS 602 Table 4 Item 3b.
M1n: Cold/Hot Weather Work | Verify preparation, construction and protection of masonry during cold weather (temperature below 40º F) or hot weather (temperature above 90º F).	TMS 602 Table 4 Item 3f. * May be performed by the project inspector when specifically approved by DSA.
M1o: Anchors and Embeds | Inspect type, size and location of anchors and all other items to be embedded in masonry including other details of anchorage of masonry	TMS 602 Table 4 Item 3d.

to structural members, frames and other construction.	
M1p: Grout Cavity | Inspect grout space, including mortar protrusions, prior to placement of grout.	TMS 602 Table 4 Item 2a.

M2. VENEER OR GLASS BLOCK PARTITIONS:	
Test or Special Inspection	**Code References and Notes**
M2a: Mortar and Grout | Verify proportions of site prepared mortar and grout and/or verify certification of premixed mortar.	TMS 602 Table 3 (row 5) and Table 4 Items 1a & 2d.
M2b: Unit Layup and Joints | Inspect placement of units and construction of mortar joints.	TMS 602 Table 4 Item 3b.
M2c: Wires and Connector | Inspect placement of wire, connectors and anchors	TMS 602 Table 4 Item 2c.
M2d: Anchors and Embeds | Inspect type, size and location of anchors and all other items to be embedded in masonry veneer including details of anchorage of masonry to veneer backing, frames and other construction.	TMS 602 Table 4 Item 3d.
M2e: Cold/Hot Weather Work | Verify preparation, construction and protection of masonry during cold weather (temperature below 40º F) or hot weather (above 90º F).	TMS 602 Table 4 Item 3f. * May be performed by the project inspector when specifically approved by DSA.
M2f: Adhered Veneer Bond | Test adhered veneer bond strength.	**1410.2.1 (Field-constructed mock-up using specified unit, mortar, and substrate, laboratory tested in accordance with ASTM C1823).**

M3. POST-INSTALLED ANCHORS IN MASONRY:	
Test or Special Inspection	**Code References and Notes**
M3a: Inspection | Inspect installation of post-installed anchors	**1617A.1.19, 1705A.4, Table 1705A.3 Item 4a (Continuous) & 4b (Periodic);** ACI 318 Section 26.13. * May be performed by the project inspector when specifically approved by DSA. (See Appendix (end of this form) for exemptions.)
M3b: Test | Test post-installed anchors.	**1705A.4, 1910A.5.** (See Appendix (end of this form) for exemptions.)

M4. OTHER MASONRY:	
Test or Special Inspection	**Code References and Notes**
M4a. | Not used.	N/A
M4b. | Not used.	N/A
M4c. | Not used.	N/A
M4d. | Not used.	N/A
M4e. | Not used.	N/A
M4f. | Not used.	N/A
M4g. | Not used.	N/A
M4h. | Not used.	N/A
M4i. | Not used.	N/A
M4j. | Not used.	N/A
M4k. | Not used.	Not used.
M4l. | Not used.	Not used.

Appendix: LIST OF STRUCTURAL TESTS AND SPECIAL INSPECTIONS

S/A1. STRUCTURAL STEEL, COLD-FORMED STEEL AND ALUMINUM USED FOR STRUCTURAL PURPOSES	
Test or Special Inspection	**Code References and Notes**
S/A1a: Material Identification | Verify identification of all materials and: • Mill certificates indicate material properties that comply with requirements. • Material sizes, types and grades comply with requirements.	**Table 1705A.2.1 Item 3a–3c.** 2202A.1**;** AISI S100 Section A3.1 & A3.2, AISI S240 Section A3 & A5, AISI S220 Sections A4 & A6. *By special inspector or qualified technician when performed off-site.
S/A1b: Unidentified Material | Test unidentified materials	**2202A.1.**
S/A1c: Steel Fabrication | Verify and document steel fabrication per DSA- approved construction documents.	Not applicable to cold-formed steel light-frame construction, except for trusses (**1705A.2.4**).
S/A1d: Buckling Restrained Brace | Verify and document steel fabrication per DSA-approved construction documents.	Testing and special inspections in accordance with IR 22-4. For DSA accepted fabrication shops, BRB manufacturer's Certificate of Compliance in lieu of testing and special inspections. See IR 22-4.

S/A2. HIGH-STRENGTH BOLTS:	
Test or Special Inspection	**Code References and Notes**
S/A2a: Product Verification | Verify identification markings and manufacturer's certificates of compliance conform to ASTM standards specified in the DSA-approved documents.	**Table 1705A.2.1 Items 1a & 1b, 2202A.1;** AISC 360 Section A3.3, J3.1, and N3.2; RCSC Section 1.5 & 2.1; DSA IR 17-8 & DSA IR 17-9.
S/A2b: Bolts, Nuts, and Washers | Test high-strength bolts, nuts and washers.	**Table 1705A.2.1 Item 1c, 2213A.1**; RCSC Section 7.2; DSA IR 17-8.
S/A2c: Snug Tight | Bearing-type ("snug tight") connections.	**Table 1705A.2.1 Item 2a, 1705A.2.6, 2204A.2**; AISC 360 J3.1, J3.2, M2.5 & N5.6; RCSC Section 9.1; DSA IR 17-9.
S/A2d: Pretensioned / Slip-Critical | Pretensioned and slip-critical connections.	**Table 1705A.2.1 Items 2b & 2c, 1705A.2.6, 2204A.2;** AISC 360 J3.1, J3.2, M2.5 & N5.6; RCSC Sections 9.2 & 9.3; DSA IR 17-9 *"Continuous" or "Periodic" depends on the tightening method used.

S/A3. WELDING:	
Test or Special Inspection	**Code References and Notes**
S/A3a: Weld Material | Verify weld filler material identification markings per AWS designation listed on the DSA-approved documents and the WPS.	**1705A.2.5, Table 1705A.2.1 Items 4 & 5**; AWS D1.1 and AWS D1.8 for structural steel; AWS D1.2 for Aluminum; AWS D1.3 for cold-formed steel; AWS D1.4 for reinforcing steel; DSA IR 17-3.
S/A3b: Certificate of Compliance | Verify weld filler material manufacturer's certificate of compliance.	DSA IR 17-3.
S/A3c: WPS and Qualifications | Verify WPS, welder qualifications and equipment.	DSA IR 17-3.

S/A4. SHOP WELDING (IN ADDITION TO SECTION S/A3):	
Test or Special Inspection	**Code References and Notes**
S/A4a: Weld Category A | Inspect groove welds, multi-pass fillet welds, single pass fillet welds > 5/16", plug and slot welds.	**Table 1705A.2.1 Items 5a.1–4;** AISC 360 (and AISC 341 as applicable); DSA IR 17-3.
S/A4b: Weld Category B | Inspect single-pass fillet welds ≤ 5/16", floor and roof deck welds.	**1705A.2.2, Table 1705A.2.1 Items 5a.5 & 5a.6;** AISC 360 (and AISC 341 as applicable); DSA IR 17-3.
S/A4c: Stairs and Railing | Inspect welding of stairs and railing systems.	**1705A.2.1**; AISC 360 (and AISC 341 as applicable); AWS D1.1 & D1.3; DSA IR 17-3.
S/A4d: Reinf. Steel Weldability | Verification of reinforcing steel weldability other than ASTM A706.	**1705A.3.1**; AWS D1.4; DSA IR 17-3. Verify carbon equivalent reported on mill certificates.
S/A4e: Reinforcing Steel | Inspect welding of reinforcing steel.	**Table 1705A.2.1 Item 5b, 1705A.3.1, Table 1705A.3 Item 2, 1903A.8;** AWS D1.4; DSA IR 17-3.

S/A5. FIELD WELDING (IN ADDITION TO SECTION S/A3):	
Test or Special Inspection	**Code References and Notes**
S/A5a: Weld Category A | Inspect groove welds, multi-pass fillet welds, single pass fillet welds > 5/16", plug and slot welds.	**Table 1705A.2.1 Items 5a.1–4;** AISC 360 (AISC 341 as applicable); DSA IR 17-3.
S/A5b: Weld Category B | Inspect single-pass fillet welds ≤ 5/16".	**Table 1705A.2.1 Item 5a.5;** AISC 360 (AISC 341 as applicable); DSA IR 17-3.
S/A5c: End Welded Studs | Inspect end-welded studs (ASTM A-108) installation (including bend test).	**2213A.2**; AISC 360 (AISC 341 as applicable); AWS D1.1; DSA IR 17-3.
S/A5d: Deck Welds | Inspect floor and roof deck welds.	**1705A.2.2, Table 1705A.2.1 Item 5a.6;** AISC 360 (AISC 341 as applicable); AWS D1.3; DSA IR 17-3.
S/A5e: Cold-Formed Steel | Inspect welding of structural cold-formed steel.	**1705A.2.5;** AWS D1.3; DSA IR 17-3. The quality control provisions of AISI S240 Chapter D shall also apply. * May be performed by the project inspector when specifically approved by DSA.
S/A5f: Stairs and Railing | Inspect welding of stairs and railing systems.	**1705A.2.1;** AISC 360 (AISC 341 as applicable); AWS D1.1 & D1.3; DSA IR 17-3. * May be performed by the project inspector when specifically approved by DSA.
S/A5g: Reinf. Steel Weldability | Verification of reinforcing steel weldability.	**1705A.3.1**; AWS D1.4; DSA IR 17-3. Verify carbon equivalent reported on mill certificates.
S/A5h: Reinforcing Steel | Inspect welding of reinforcing steel.	**Table 1705A.2.1 Item 5b, 1705A.3.1, Table 1705A.3 Item 2, 1903A.8;** AWS D1.4; DSA IR 17-3.

S/A6. NONDESTRUCTIVE TESTING:	
Test or Special Inspection	**Code References and Notes**
S/A6a: Ultrasonic | Ultrasonic	**1705A.2.1, Table 1705A.2.1 Item 4c, 1705A.2.5;** AISC 341 J6.2, AISC 360 N5.5; AWS D1.1, AWS D1.8; DSA IR 17-2.
S/A6b: Magnetic Particle | Magnetic Particle	**1705A.2.1, Table 1705A.2.1 Item 4c, 1705A.2.5;** AISC 341 J6.2, AISC 360 N5.5; AWS D1.1, AWS D1.8; DSA IR 17-2.
S/A6c: Not used.	N/A
S/A6d: Not used.	N/A
S/A6e: Not used.	N/A

S/A7. STEEL JOISTS AND TRUSSES:	
Test or Special Inspection	**Code References and Notes**
S/A7a: Fabrication | Verify size, type and grade for all chord and web members as well as connectors and weld filler material; verify joist profile, dimensions and camber (if applicable); verify all weld locations, lengths and profiles; mark or tag each joist.	**1705A.2.3, Table 1705A.2.3;** AWS D1.1; DSA IR 22-3 for steel joists only. **1705A.2.4;** AWS D1.3 for cold-formed steel trusses.

S/A8. SPRAYED FIRE-RESISTANT MATERIALS:	
Test or Special Inspection	**Code References and Notes**
S/A8a: Surface and Installation | Examine structural steel surface conditions, inspect application, take samples, measure thickness and verify compliance of all aspects of application with DSA-approved documents.	**1705A.15, 1705A.15.1, 1705A.15.2, 1705A.15.3, 1705A.15.4, 1705A.15.5, 1705A.15.6.**
S/A8b: Density | Test density.	**1705A.15.1, 1705A.15.5, ASTM E605**
S/A8c: Bond: Adhesion/Cohesion | Bond strength adhesion/cohesion.	**1705A.15.1, 1705A.15.6, ASTM E736**

S/A9. ANCHOR BOLTS AND ANCHOR RODS:	
Test or Special Inspection	**Code References and Notes**
S/A9a: Anchor Rods and Bolts | Anchor Bolts and Anchor Rods	Identify, sample and test anchor bolts and anchor rods **not** meeting exemptions identified in Section 1 of IR 17-11.
S/A9b: Other Threaded Rods | Threaded rod not used for foundation anchorage.	Identify, sample and test threaded rods **not** meeting exemptions identified in Section 1 of IR 17-11.

S/A10. STORAGE RACK SYSTEMS:	
Test or Special Inspection	**Code References and Notes**
S/A10a: Material Verification | Materials used, to verify compliance with one or more of the material test reports in accordance with the approved construction documents.	Table 1705A.13.7
S/A10b: Fabrication | Fabricated storage rack elements.	1704A.2.5; Table 1705A.13.7
S/A10c: Anchorage | Storage rack anchorage installation.	ANSI/MH16.1 Section 7.3.2; Table 1705A.13.7
S/A10d: Completed System | Completed storage rack system to indicate compliance with the approved construction documents.	Table 1705A.13.7; * May be preformed by the project inspector when specifically approved by DSA.

S/A11. Other Steel	
Test or Special Inspection	**Code References and Notes**
S/A11a. | Not used.	N/A
S/A11b. | Not used.	N/A
S/A11c. | Not used.	N/A
S/A11d. | Not used.	N/A
S/A11e. | Not used.	N/A
S/A11f. | Not used.	N/A
S/A11g. | Not used.	N/A
S/A11h. | Not used.	N/A
S/A11i. | Not used.	N/A
S/A11j. | Not used.	N/A
S/A11k. | Not used.	Not used.
S/A11l. | Not used.	Not used.

W1. PREFABRICATED WOOD TRUSSES:	
Test or Special Inspection	**Code References and Notes**
W1a: Open Web Truss Fabrication | Inspect fabrication of manufactured open-web trusses.	**1705A.5.6;** DSA IR 23-8.
W1b: Metal Plate Truss Fabrication | Inspect fabrication of manufactured metal-plate- connected trusses.	**1705A.5.6, 1705A.5.7;** DSA IR 23-4.

W2. MANUFACTURED WOOD STRUCTURAL ELEMENTS:	
Test or Special Inspection	**Code References and Notes**
W2a: GLS Timber Fabrication | Inspect fabrication of structural glued-laminated timber.*	* See **1705A.5.5** for exceptions
W2b: CLT Fabrication | Inspect fabrication of cross-laminated timber.	**1705A.5.5**
W2c: Mass Timber Erection | Inspect erection of mass timber.	**Table 1705A.5.3**, Item 2
W2d: Connections Type A | Inspect mass timber connections with threaded fasteners, bolts, and/or adhesive anchors other than described in item e below. Inspect concealed mass timber connections.	**Table 1705A.5.3**, Items 3.1, 3.3, 3.4, 3.5. For threaded fasteners: Verify use of proper installation equipment. Verify use of pre-drilled holes where required. Inspect screws, including diameter, length, head type, spacing, installation angle, and depth.
W2e: Connections Type B | Inspect mass timber connections with adhesive anchors installed in a horizontal or upward orientation.	**Table 1705A.5.3**, Item 3.2
W2f: Sealants | Inspect application of sealants or adhesives applied to mass timber elements.	**1705A.20**

W3. OTHER Wood:	
Test or Special Inspection	**Code References and Notes**
W3a. | Not used.	N/A
W3b. | Not used.	N/A
W3c. | Not used.	N/A
W3d. | Not used.	N/A
W3e. | Not used.	N/A
W3f. | Not used.	N/A
W3g. | Not used.	N/A
W3h. | Not used.	N/A
W3i. | Not used.	N/A
W3j. | Not used.	N/A
W3k. | Not used.	Not used.
W3l. | Not used.	Not used.

X1. OTHER:	
Test or Special Inspection	**Code References and Notes**
X01. | Load test for identified product(s):	1709A.2, 1709A.3. Testing is not required for: 1) a product with a valid evaluation service report per DSA IR A-5, or 2) a product that can be justified by structural calculation.
X02. | Installation torque for non-HS bolts on communication tower identified as essential service facility projects (ESFP).	Calibrated wrench use required, verified by SI during installation. DSA Policy PL 18-01: Communication Towers, Poles and Buildings Utilized by State Agencies for Essential Services Communications. *EXCEPTION: Non-ESFP may use PI without need for notification to DSA.
X03. | Solar Panel Attachment	Pre-tension bolt connections and calibration of test equipment
X04. | Solar Panel Atta. Bolts	Bolts shall be identified, sampled and tested in accordance with DSA IR 17-8.19
X05. | Not used.	N/A
X06. | Not used.	N/A
X07. | Not used.	N/A
X08. | Not used.	N/A
X09. | Not used.	N/A
X10. | Not used.	N/A

EXEMPTIONS

SOILS - EXEMPTIONS:
Soils: Eligible shallow foundation elements | Shallow foundations, are exempt from special inspections and testing by a Geotechnical Engineer for the following cases: A) buildings without a geotechnical report and meeting the exception Item #1 criteria in CBC Section 1803A.2 supported by native soil (any excavation depth) or fill soil (not exceeding 12" depth per CBC, Section 1804A.6), B) soil scarification/recompaction not exceeding 12" depth, C) native or fill soil supporting exterior non-structural flatwork (e.g., sidewalks, site concrete ramps, site stairs, parking lots, driveways, etc.), D) unpaved landscaping and playground areas, or E) utility trench backfill with depth not exceeding 12". These exempt structures shall be identified on the approved construction documents.
Soils: Eligible deep foundation elements, Type 1 | Deep foundation acting as cantilever footing with a design based on minimum allowable pressures per CBC Table 1806A.2 and without a geotechnical report are exempt from special inspection and testing by a Geotechnical Engineer for the following cases: A) free standing sign or scoreboard, B) cell or antenna towers and poles less than 35'-0" tall (e.g., lighting poles, flag poles, poles supporting open mesh fences, etc.). These exempt structures shall be identified on the approved construction documents.
Soils: Eligible deep foundation elements Type 2 | Deep foundation acting as cantilever footing with a design based on minimum allowable pressures per CBC Table 1806A.2 and without a geotechnical report are exempt from special inspection and testing by a Geotechnical Engineer for the following cases: A) single-story open fabric shade structure, or B) covered walkway structure with an apex height less than 10'-0" above adjacent grade. These exempt structures shall be identified on the approved construction documents.

CONCRETE/MASONRY - EXEMPTIONS:
Concrete/Masonry: Eligible post-installed anchors | Post-installed anchors for the following: A) exempt non-structural components (e.g., mechanical, electrical, plumbing equipment – see item 7 for "Welding" in the Appendix below) given in CBC Section 1617A.1.18 or B) interior nonstructural wall partitions meeting criteria listed in exempt item 3 for "Welding" in the Appendix below.
Concrete: Batch plant inspection for items listed in and complying with CBC Section 1705A.3.3.2. | Concrete batch plant inspection is not required for items given in CBC Section 1705A.3.3.2 subject to the requirements and limitations in that section.
Concrete: Epoxy shear dowels in nonstructural slab-on-grade per CBC Section 1910A.5.4, Exception #4. | Epoxy shear dowels in site flatwork and/or other nonstructural concrete.
Concrete/Masonry: Reinforcing bar testing for items listed in and complying with CBC Section 1910A.2. | Testing of reinforcing bars is not required for items given in CBC Section 1910A.2 subject to the requirements and limitations in that section. These exempt structures shall be identified on the approved construction documents.
Masonry: Freestanding site walls and retaining walls per DSA IR 21-1. | Freestanding and site retaining masonry walls may be exempt from certain DSA masonry testing and special inspection items as allowed per DSA IR 21-1.
Eligible precast elements | Structural tests and special inspections are not required for the following concrete precast elements. Provide a certificate of compliance at delivery. Exemptions shall be identified on the approved construction documents. 1. Underground vaults no greater than 5 feet x 5 feet x unlimited height and pipe manufactured to an ASTM standard, 5 foot or less in diameter. 2. Elements manufactured in a PCI or NPCA certified manufacturing plant:

A. Underground vaults no greater than 16 feet in both length and width, of unlimited height, not subject to loading greater than HS 20-44. B. Pipe. C. Stair treads, landing planks.

WELDING - EXEMPTIONS:
Welding: Eligible fences and gates | Fences, gates with maximum leaf span of 10', and gates with a maximum rolling section of 10' all having an apex height less than 8'-0" above lowest adjacent grade.
Welding: Eligible railing and ramps | Handrails, guardrails, and modular or relocatable ramps associated with walking surfaces less than 30" above adjacent grade; fillet welds shall not be ground flush.
Welding: Eligible interior cold-formed steel framing | Non-bearing non-shearwall interior cold-formed steel framing spanning less than 15'-0" in height and header less than 10'-0" in opening width, such as in interior partitions, interior soffits, etc.
Welding: Eligible equipment curbs | Manufactured support frames and curbs using hot rolled or cold-formed steel (i.e., light gauge) for mechanical, electrical, or plumbing equipment weighing less than 2000# (equipment only) (connections of such frames to superstructure elements using welding will require special inspection.)
Welding: Eligible components supporting MEP distribution systems | Manufactured components (e.g., Tolco, B-Line, Afcon, etc.) for mechanical, electrical, or plumbing hanger support and bracing (connections of such components to superstructure elements using welding will require special inspection.)
Welding: Eligible mounts and recreational equipment | TV Brackets, projector mounts with a valid listing (see DSA IR A-5) and recreational equipment (e.g., playground structures, basketball backstops, etc.) (connections of such elements to superstructure elements using welding will require special inspection.)
Welding: Eligible nonstructural components | Any support for exempt non-structural components given in CBC Section 1617A.1.18 meeting the following: A) when supported on a floor/roof, <400# or resulting composite center of mass (including component's center of mass) ≤4' above supporting floor/roof, B) when hung from a wall or roof/floor, and <20# for discrete units or <5 plf for distributed systems.

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide construction facilities and temporary controls needed for the Work including, but not necessarily limited to:
   1. Temporary utilities such as heat, water, electricity, and telephone;
   2. Field offices;
   3. Sanitary facilities;
   4. Enclosures such as tarpaulins, barricades, safety devices, and canopies;
   5. Temporary fencing of the construction site and/or buildings as required to secure the project;
   6. Temporary protect of new and existing work;
   7. Project sign.
   8. Temporary protection of existing buildings and site.

B. Related Sections:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. Except that equipment furnished by subcontractors shall comply with requirements of pertinent safety regulations, such equipment normally furnished by the individual trades in execution of their own portions of the Work is not part of this Section.
   3. Permanent installation and hookup of the various utility lines are described in other Sections.

1.2 QUALITY ASSURANCE

A. Comply with governing regulations and rules/recommendations of utility companies and governmental agencies having jurisdiction.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Maintain temporary facilities and controls in proper and safe condition throughout progress of the Work.

PART 2 - PRODUCTS

2.1 TEMPORARY UTILITIES

A. Water:
   1. Provide necessary temporary piping and water supply and, upon completion of the Work, remove such temporary facilities.
   2. Provide and pay for water used in construction.
   3. Provide fire hydrants in working order and approved by the local fire agency having jurisdiction and fire access roads as indicated prior to delivering combustible materials to the job site.

B. Electricity:
   1. Provide all necessary temporary poles and wiring and, upon completion of the Work, remove such temporary facility.
   2. Provide area distribution boxes so located that the individual trades may furnish and use 100 ft maximum length extension cords to obtain power and lighting at points where needed for work, inspection, and safety.

3. Provide lighting as needed to permit safe and reasonable lighted working conditions.
4. Provide and pay for electricity used in construction.

C. Provide for and maintain safety during construction per Chapter 33 of the 2022 California Fire Code and DSA Bulletin 24-05. Within 7 calendar days of the Notice of Award, the Contractor shall meet with the Owner, develop a Site Safety Plan (SSP) and submit the SSP in .pdf format to the Architect who will submit the SSP to DSA for review. Additional contract time will not be granted for failure of DSA to approve the Contractor's plan. At a minimum, the SSP shall include the following information required in CFC Section 3303.1.1:
   1. Name and contact information of site safety director.
   2. Documentation of training of the site safety director and fire watch personnel.
   3. Procedures for reporting emergencies.
   4. Fire department vehicle access routes.
   5. Locations of fire protection equipment, including portable fire extinguishers, standpipes, fire department connections and fire hydrants.
   6. Smoking and cooking policies, designated area to be used where approved, and signage locations in accordance with CFC Section 3305.8.
   7. Location and safety considerations for temporary heating equipment.
   8. Hot work (welding, roofing, etc.) plan.
   9. Plans for control of combustible waste.
   10. Locations and methods for storage and use of flammable and combustible liquids and other hazardous materials.
   11. Provisions for site security.
   12. Changes that affect this plan.
   13. Other site specific information requested by the local fire authority (LFA).

D. Safeguards During Construction: Provide for and maintain safeguards during construction and/or alteration of a building per Chapter 33 of the 2022 California Building Code.

E. Heating: Provide and maintain heat necessary for proper conduct of operations and temperature conditions needed for the Work.

F. Ventilation: Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and prevent accumulation of dust, fumes, vapors, or gases.

G. Telephone/Fax:
   1. Make necessary arrangements and pay costs for installation and operation of telephone, FAX, internet service and copier service in the Contractor's office at the site.
   2. Provide telephone and fax lines in the office of the Project Inspector for use in connection with the Work.
   3. Costs of telephone and fax calls in the Inspector's office are not in contract.

2.2 FIELD OFFICES AND SHEDS

A. Office Facilities:
   1. Contractor's Office: Provide a field office (8' by 12' minimum size) and sheds adequate in size and accommodation for Contractor's offices, supply, and storage.
   2. Secure portable or mobile buildings when used. Provide steps and landings at each doorway. Meet all applicable codes and regulations.
   3. Remove all facilities when they are no longer needed, but only after approval of the Architect.
   4. Inspector's Office: Provide a private space within the field office (8' by 16' minimum size), or a separate job trailer with adequate heating and cooling, power, and telephone outlets for the Project Inspector and for holding project meetings.
      a. Provide 30"x84" table and 8 chairs.

b. Provide windows (approximately 10% of floor area) oriented to the construction areas.
c. Provide plan table and stool for inspector.

B. Sanitary Facilities:
1. Provide temporary sanitary facilities in the quantity required for use by all personnel per local and state health and sanitary regulations.
2. Maintain in a sanitary condition at all times and in reasonable proximity of the work.

2.3 TEMPORARY ENCLOSURES

A. Provide and maintain for the duration of construction all scaffolds, tarpaulins, canopies, warning signs, steps, platforms, bridges, lighting, and other temporary construction necessary for the safe and proper completion of the Work in compliance with pertinent safety and other regulations.

B. Provide and maintain suitable temporary sidewalks, closed passageways, fences, and other structures required by law so as not to obstruct or interfere with traffic in public streets, alley ways, or private right-of-way. Leave an unobstructed way along public and private places for pedestrians and vehicles.

C. Provide temporary partitions and ceilings as needed to separate work areas from Owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, and to prevent damage to existing materials and equipment.

2.4 TEMPORARY FENCING

A. Provide and maintain temporary fencing for the duration of construction to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

B. Minimum fence height shall be 6'-0" high. Fence panels shall be stretched over 4-sided pipe frames.

2.5 VEHICULAR ACCESS AND PARKING

A. Access the site as indicated on the Drawings, or as directed by the Owner.

B. Do not use existing parking areas for the Contractor's parking or storage of materials.

C. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on the site.

D. Construct and maintain temporary roads accessing public thoroughfares to serve construction area. Extend and relocate as the Work requires.

E. Provide and maintain access to fire hydrants, free of obstructions, with an all-weather hard surface able to support 50,000 pounds minimum fire apparatus. Fire hydrants shall be charged and accessible by local fire authorities prior to loading the site with combustible materials.

F. Employees vehicles not required for the direct construction of the Work shall be parked offsite unless otherwise authorized by the Owner.

2.6 DUST PROTECTION

A. Provide dust suppression measures, including watering of all graded or excavated material at least twice a day, stopping grading and excavation activities when the wind speed exceeds 20 mph for one hour, watering or

covering all material transported off-site, and minimizing the area disturbed by grading and excavation activities.

B. Maintain adequate water and trucks to be used throughout the progress of the project to mitigate airborne dust. Maintain the site in a damp condition, not allowing excessive powdering of soil.

2.7 PROTECTION

A. Landscaping: Protect all existing trees, shrubs, lawns, and landscape work from damage, providing guards and coverings. Maintain by irrigation any existing trees, shrubs, lawns, and landscape work though-out the Contract which are within the Contractor's temporary fencing. Damaged landscaping shall be repaired or replaced at the Contractor's expense.

B. Public and Private Streets, Curbs, and Walks:
   1. Protect all existing streets, curbs, walks, and other street improvements and immediately make all necessary repairs for damage occurring thereto during the course of the Work at the Contractor's expense.
   2. Keep all public and private streets and ways clean of debris, spilled materials and products, and wet and dry earth at all times and clean at the end of each working day. Clean wet earth from vehicles prior to their leaving the site.

C. Weather: Provide protection at all times against weather--rain, winds, storms, frost, or heat--so as to maintain all work, materials, apparatus, and fixtures free from injury or damage. At the end of the day's work, cover all work likely to be damaged.
   1. Water Protection: Protect excavations, trenches, and/or building from damage from rain water, spring water, ground water, backing up of drains or sewers, and all other water at all times. Provide pumps and equipment and enclosure necessary to provide this protection.
   2. Drainage: Construct and maintain all necessary temporary drainage and do all pumping necessary to keep excavations free of water.
   3. Cold Weather: During cold weather, protect all work from damage.
   4. Snow and Ice: Remove all snow and ice as may be required for proper protection and/or prosecution of the Work.

D. Installed Roofing Materials: Provide means for protection of roofing materials during construction activities. Provide a minimum of 3/4" plywood as protection for storage or materials, walking areas, and working areas. Protect from solvents, oils, or other materials harmful to the installed roofing material.

E. Existing Utilities and Services: Maintain in operation through-out the Contract all existing utilities and services serving the existing facilities occupied by the Owner or by others.

F. Existing Structures and Improvements: The Contractor shall be responsible for all existing structures and improvements within the work area, and shall provide adequate protection. Any existing structure or improvement damaged during construction shall be repaired or replaced with materials, fixtures, or equipment of the same kind, quality, and size. Any materials, and/or equipment temporarily removed for protection and not damaged, shall be reinstalled.

G. Adjacent Property: Provide necessary protection for adjacent property and the lateral support therefor in conformance with the 2022 California Building Code.

2.8 SECURITY

A. The Contractor shall be responsible for security and protection of his equipment and the site-stored and installed products whether paid for by the Owner or not, until the Owner accepts the Project.

B. On-site security lighting shall be hooded and adjusted to reduce or eliminate illumination of surrounding properties and roadways.

2.9 DEBRIS CONTROL

A. Keep site clean and orderly in appearance at all times. Do not allow debris to accumulate over the site.

B. Collect debris daily and store in a central location or container. Remove from the site monthly prior to review of payment request.

2.10 PROJECT SIGN

A. Provide a project sign bearing the project name and the names of the Owner, Architect, consulting engineers (structural, mechanical, electrical, and civil), and Contractor, company logos, and other information as directed by the Architect. Sign shall be 4’ x 8’ x 1/2”plywood minimum.
   1. Submit sign drawing for review and approval by the Architect.
   2. Place sign in a prominent location as directed by the Architect.
   3. Sign shall be in place prior to approval of first payment request.
   4. Maintain sign in place during construction; remove and dispose of sign after project acceptance.

PART 3 - EXECUTION

3.1 MAINTENANCE AND REMOVAL

A. Maintain temporary facilities and controls as long as needed for safe and proper completion of the Work.

B. Remove such temporary facilities and controls as rapidly as progress of the Work will permit, or as directed by the Architect.

END OF SECTION 01 5000

SECTION 01 5710 - EROSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. In accordance with pertinent provisions of this Section, install erosion control straw mat, straw wattles, and/or straw bales as needed to meet the requirements of the construction shown in the Contract Documents.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 01 5725: Storm Water Pollution Prevention Plan.
3. Section 31 1000: Site clearing.
4. Section 33 4000: Storm drainage.

1.2 QUALITY ASSURANCE

A. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

B. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the geotechnical engineer.

C. Install erosion control materials prior to expected rainfall and maintain throughout the construction period.

D. Comply with storm water pollution prevention plan.

1.3 SLOPE PROTECTION

A. Minor Slopes: Provide continuous straw mat protection over all soils disturbed by construction operations. Minor slopes shall be slope with finish grade less than 10 horizontal to 1 vertical, up to 6.5 horizontal to 1 vertical.

B. Major Slopes: Provide continuous straw mat protection plus horizontal trench with continuous straw wattles at 4' on center over all soils disturbed by construction operations. Major slopes shall be slope with finish grade equal to or greater than 6.5 horizontal to 1 vertical.

1.4 EXISTING UTILITIES

A. Field verify the location of all existing underground utilities prior to beginning any earthwork. Work around and protect all existing utilities during the course of the Work.

B. Where existing utilities are indicated on the drawings, extreme care shall be exercised in excavating near these utilities to avoid damage, and the Contractor will be held responsible for any damage caused by construction operations.

PART 2 - PRODUCTS

2.1 EROSION CONTROL MATTING

A. Erosion control matting shall be straw blanket of 100% agricultural straw fiber matrix with a functional longevity of 6 months or greater. Evenly distribute straw fiber over the entire area of the mat. The blanket shall be covered on the top and bottom with a lightweight photodegradable polypropylene net with mesh size of approximately ½" by ½". Sew blanket together on 1.5" centers with degradable thread.

B. Acceptable Products:
1. North American Green, S150 straw erosion control blanket.
2. Cascade Geotechnical Inc., S-31 LD straw erosion control blanket.
3. Erosion Control Systems, ProGuard SS straw erosion control blanket.
4. Other equal product approved by the Architect.

2.2 STRAW WATTLES

A. Straw wattles are intended to capture and keep sediment on the slopes. Wattles shall be manufactured from 100% agricultural rice straw and wrapped in tubular black plastic netting or hemp. They are approximately 8" in diameter or larger by 25'-30' in length.

B. Acceptable Products:
1. California Straw Works,
2. Other equal product approved by the Architect

2.3 STRAW BALES

A. Provide Straw Bales continuously around all drainage inlets and maintain them to prevent silt build-up in storm drainage pipe. Clean storm drain pipes prior to acceptance of the project and verify there are no obstructions.

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 EROSION CONTROL MATTING

A. Provide straw bales as required for loose spreading straw over native disturbed soil during grading operations and foundation and stem wall construction. Fine grade soil as soon after floor and wall framing is complete but before anticipated rainfall.

B. Install erosion control matting at the top of the slope by anchoring the mat into an earthen trench and anchor as recommended by the manufacturer.

C. Roll mats downhill and then horizontally with laps and staples as recommended by the manufacturer.

3.3 STRAW WATTLES

A. Prepare slope with Erosion Control Matting prior to laying the wattling material.

B. Dig and smooth trenches across the slope on contour, to place rolls. Provide trench depth as recommended by the manufacturer, but not less than ½ the diameter of the roll.

C. Trenches shall be placed 4' on center and perpendicular to water flow.

D. Anchor wattles in place with stakes driven and spaced as recommended by manufacturer.

3.4 FIELD QUALITY CONTROL

A. Inspect the erosion control blanket and wattles immediately following the first significant storm. Make sure all rolls are in full contact with soils.

B. Repair any gullys or washouts immediately.

C. Provide gravel or river rock in areas of excessive erosion acceptable to the Architect and at no additional cost to the Owner.

END OF SECTION 01 5710

SECTION 01 5725 - STORM WATER POLLUTION PREVENTION PLAN

PART 1 - GENERAL

1.1 SUMMARY

A. The State Water Resources Control Board (SWRCB) regulates storm water discharges associated with construction and land disturbance activities under the National Pollutant Discharge Elimination System (NPDES). Projects that disturb 1 acre or more, or are part of a common plan of development, are required to obtain permit coverage under the 2022 Construction General Permit (CGP), Order 2022-0057-DWQ, NPDES No. CAS000003. A site-specific Storm Water Pollution Prevention Plan (SWPPP) is required to obtain permit coverage under the CGP.

B. The Central Valley Regional Water Quality Control Board, Region 5F (RWQCB) is the regional authority responsible for inspections, compliance oversight, and enforcement of the CGP for this project.

C. Related Sections
1. Section 01 5710: Erosion and Sediment Control

D. The Owner or Owner's authorized agent is responsible for filing the Notice of Intent (NOI) in SMARTS, paying the annual fee, obtaining CGP coverage, and verifying that a site-specific SWPPP is prepared by a Qualified SWPPP Developer (QSD) prior to the start of construction.
1. The Contractor shall provide all requested project information nee3ded by the Owner or QSD to complete the NOI and obtain permit coverage.
2. The Owner has prepared and paid for the SWPPP. The SWPPP will be provided to the Contractor prior to the commencement of construction activities and must be maintained onsite (digital or printed) at all times in accordance with the 2022 CGP.
3. This project is a Risk Level 1 project. All applicable requirements for the 2022 CGP for the assigned Risk Level and associated Risk Level Requirements shall apply.

E. Nothing in this Section relieves the Contractor, subcontractors, or the Contractor's Qualified SWPPP Practitioner (QSP) from full compliance with the 2022 CGP and all applicable laws and regulations.

1.2 REFERENCES

A. National Pollution Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities, Order No. 2022-0057-DWG, NPDES No. CAS000003.

B. All applicable amendments, fact sheets, and attachments contained in or associated with Order No. 2022-0057-DWQ.

C. California Stormwater Quality Association (CASQA) Construction BMP Handbook, latest edition.

1.3 QUALITY ASSURANCE

A. The individual responsible for implementing and overseeing SWPPP compliance shall be a QSP certified through CASQA and fully trained in all requirements of the 2022 CGP.

B. The Contractor's QSP shall have an active Storm Water Multiple Application & Report Tracking System (SMARTS) account and shall be authorized by the Owner/LRP within SMARTS to conduct inspections, upload documents, and certify reports as allowed under the CGP.

C. Contractor shall install, maintain, and repair all Best Management Practices (BMPs) identified in the SWPPP and on the Water Pollution Control Plan (WPCP) drawings, in accordance with manufacturer requirements, CASQA specifications, and 2022 CGP Attachment E BMP requirements.

D. The QSP shall implement additional BMPs as necessary to ensure compliance with the 2022 CGP, even if such BMPs are not explicitly shown in the SWPPP, when field conditions indicate they are needed.

E. The QSP shall be responsible for notifying the QSD of any significant discrepancies, changes in site conditions, or the need for SWPPP amendments. The QSD will make revisions to the SWPPP and issue amendments as applicable. Upon receiving amendments or other revised documents, the QSP shall be responsible for inserting these documents into the SWPPP and keeping them through the life of the Construction project.

F. The Contractor shall provide adequate personnel, equipment, and materials to implement all SWPPP BMPs in a timely manner and prevent violations of the CGP.

G. All inspections, sampling (if required), and Rain Event Action Plans (REAPs) shall be completed in accordance with the 2022 CGP requirements for the applicable Site Type / Risk Level.

1.4 SUBMITTALS

A. The Contractor shall submit a copy of the QSP's certificate no later than 1 week prior to the commencement of construction activities.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Erosion control products shall comply with those products named in Section 01 5710

B. Provide materials, not specifically described but required for proper completion of the work of this Section, as selected by the Contractor, subject to approval of the Architect.

C. Specific materials shall comply with the Erosion Control Plan/Water Pollution Control Drawings and should comply with the applicable BMP Fact Sheets in the CASQA BMP Handbook.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the site and the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work.

3.2 IMPLEMENTATION

A. The QSP shall implement the SWPPP in accordance with the Contract Documents and as required in the CGP.

B. The SWPPP Binder(s) and other Storm Water Pollution Prevention Documents shall be kept on the construction site at all times. It shall be made readily available for a RWQCB inspector.

C. The construction schedule shall be inserted into the SWPPP Binder and any subsequent revisions to the construction schedule.

D. The QSP shall be responsible for conducting and documenting all training activities in accordance with the CGP. The documentation of the training activities shall be inserted and kept in the project SWPPP. The training activities shall consist of:
   1. Training for individuals responsible for all activities associated with the CGP (i.e. general contractor, site superintendents and subcontractors)
   2. Training for all individuals responsible for BMP installation, inspection, maintenance and repair

E. The QSP shall be responsible for coordinating with the Legally Responsible Person (LRP), or Owner to be added to as a Data Entry Person on the LRP's SMARTS account.

F. The Contractor's QSP shall be responsible for completing and filing all annual reports on SMARTS and shall coordinate with the LRP for necessary certifications. Annual Reports shall be submitted no later than September 1st of each compliance year. The QSP shall complete and file all annual reports as required by the CGP.

G. The QSP shall be responsible for responding to any Notice of Violations (NOVs) or Staff Enforcement Letters (SELs) that may be issued by the RWQCB for non-compliance. The Contractor's QSP shall also be responsible for responding to the RWQCB and preparing any technical reports or other documents that may be requested by the RWQCB.

H. The QSP shall file a Notice of Termination on the SMARTS website no later than 30 days from the completion of the project.

I. If delays in construction occur that cause construction to continue beyond the contracted end date, that are solely the responsibility of the Contractor, the Contractor shall be held responsible for additional costs associated with implementing the SWPPP in accordance with the CGP, and any fines levied by the Regional Water Quality Control Board.

J. At the termination of construction activities and after the Notice of Termination has been approved by the SWRCB, the Contractor shall be responsible for delivering the SWPPP, including all amendments, inspections forms and any other documents added during the course of construction to the Architect.

3.3 FIELD QUALITY CONTROL

A. The Contractor and the Contractor's QSP shall be responsible for ensuring all subcontractors on the site comply with the SWPPP and the CGP and their individual actions do not result in any enforcement actions. The Contractor shall be liable for non-compliance fines from the RWQCB or SWRCB.

B. All construction trades, including their supplies who enter the construction site shall comply with the Good Housekeeping Measures named in Section B of Attachment C of the CGP.

C. Upon commencement of construction, a rain gauge shall be installed on the site in a prominent location where it will not be shielded from rainfall.

D. Install BMPs where noted on the Drawing(s) and maintain as required by the CGP throughout the life of the construction project. BMPs shall be replaced at the discretion of the QSP to comply with the CGP.

E. At the end of each workday all stockpiles shall be covered and protected around their perimeter.

F. All trash and debris shall be cleaned up and properly disposed of at the end of each work day.

G. The QSP or an individual under the direct supervision of the QSP shall conduct all inspections, maintenance repair and sampling activities. Records of inspections shall be kept using a form provided by the SWRCQ, RWQCB,

CASQA, or another alternative format.

H. Upon identification of BMP failures or shortcomings during inspections, effective remedies shall be implemented within 72 hours of identification.

END OF SECTION 01 5725

SECTION 01 6200 - PRODUCT OPTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section describes product options available to bidders and the Contractor.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 01 2500: Substitution procedures.
3. Section 01 3300: Submittal procedures.

1.2 PRODUCT OPTIONS

A. The Contract shall be based on standards of quality established in the Contract Documents.
1. In agreeing to the terms and conditions of the Contract, the Contractor has accepted a responsibility to verify that the specified products will be available and to place orders for all required materials in such a timely manner as is needed to meet his agreed construction schedule.
2. Neither the Owner nor the Architect has agreed to the substitution of materials or methods called for in the Contract Documents, except as they may specifically otherwise state in writing.

B. Colors: Provide finish selections indicated in the Finish Schedule.
1. Acceptable Manufacturers: The products and manufacturers specified in the Finish Schedule are for purposes of establishing color and quality. Refer to each Specification Section for additional manufacturers and Section 01 2500 for substitution requirements.
2. Manufacturer's Standard Colors and Finishes: Where the Finish Schedule specifies a manufacturer's standard color or finish, the Architect makes no guarantee that matching colors or finishes are available as other manufacturer's "standard colors" from the listing of acceptable manufacturers. The Contractor shall be responsible for providing colors matching those indicated on the Drawings.
3. Custom Colors: Where the Finish Schedule indicates a specific manufacturer's colors, other acceptable manufacturers shall provide matching custom colors where a standard color is not acceptable.

1.3 DELAYS

A. Delays in construction arising by virtue of the non-availability of a specified material due to late approval and/or ordering of materials will not be considered as justifying an extension of the agreed Time of Completion, or reason for change.

B. All additional time required by the Architect or his consultants in dealing with such delay will be charged to the Contractor at the rates described in section 01 7700 1.4.B.2.

C. Equal or better material replacements caused by delay in approvals and/or ordering may cost more than the original material specified. Increased costs shall be absorbed by the Contractor and not the Owner.

END OF SECTION 01 6200

SECTION 01 6600 - STORAGE AND PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Protect products scheduled for use in the Work by means including, but not necessarily limited to, those described in this Section.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Additional procedures also may be prescribed in other Sections of these Specifications.

1.2 QUALITY ASSURANCE

A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

B. **Materials not properly stored will not be paid for by the owner. Materials previously paid for but not properly stored at time of payment request will be deducted from the request.**

1.3 MANUFACTURERS' RECOMMENDATIONS

A. Except as otherwise approved by the Architect, determine and comply with manufacturers' recommendations on product handling, storage, and protection.

1.4 PACKAGING

A. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.
1. Maintain packaged materials with seals unbroken and labels intact until time of use.
2. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.

B. The Architect may reject as noncomplying such material and products that do not bear identification satisfactory to the Architect as to manufacturer, grade, quality, and other pertinent information.

1.5 PROTECTION

A. Protect finished surfaces, including jambs and soffits of openings used as passageways, through which equipment and materials are handled.

B. Provide protection for finished floor surfaces in traffic areas prior to allowing equipment or materials to be moved over such surfaces.

C. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.

1.6 REPAIRS AND REPLACEMENTS

A. In event of damage, promptly make replacements and repairs to the approval of the Architect and at no additional cost to the Owner. Additional time required to secure replacements and to make repairs will not be considered by the Architect to justify an extension in the Contract Time of Completion.

END OF SECTION 01 6600

SECTION 01 7120 - FIELD ENGINEERING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide such field engineering, staking services, and required certifications as required for proper completion of the Work including, but not necessarily limited to establishing and maintaining lines and levels.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Additional requirements for field engineering also may be described in other Sections of these Specifications.
3. As described in the General Conditions, the Owner will furnish survey describing the physical characteristics, legal limitations, utility locations, and legal description of the site.

1.2 SUBMITTALS

A. Comply with pertinent provisions of Section 01 3300.

B. Submit the following:
1. Data demonstrating qualifications of persons proposed to be engaged for field engineering services.
2. Documentation verifying accuracy of field engineering work
3. Certification, signed by the Contractor's retained licensed land surveyor or civil engineer, certifying that Bottom of Excavations, Top of Slab Elevations and locations of improvements are in conformance with requirements of the Contract Documents.

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 PROCEDURES

A. In addition to procedures directed by the Contractor for proper performance of the Contractor's responsibilities:
1. Locate and protect control points before starting work on the site.
2. Preserve permanent reference points during progress of the Work.
3. Do not change or relocate reference points or items of the Work without specific approval from the Architect.
4. Promptly advise the Architect when a reference point is lost or destroyed, or requires relocation because of other changes in the Work.
    a. Upon direction of the Architect, require the field engineer to replace reference stakes or markers.
    b. Locate such replacements according to the original survey control.

END OF SECTION 01 7120

SECTION 01 7300 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section establishes administrative and supervisory requirements pertaining to project coordination and general installation provisions.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 COORDINATION

A. Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
   1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
   2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Inspection of Conditions: Require the installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

G. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement. Comply with manufacturer’s installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in the Contract Documents.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

F. Provide attachment and connection devices and methods necessary for securing Work. Allow for expansion and building movement.

G. Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

H. Recheck measurements and dimensions prior to starting installation.

I. Install each component during weather conditions and project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

J. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

K. Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.4 SITE CONDITIONS

A. Where existing utilities are indicated on the drawings, extreme care shall be exercised in excavating near these utilities to avoid damage, and the Contractor will be held responsible for any damage caused by construction operations.

B. Should utilities not indicated on the drawings be found during construction, the Contractor shall promptly notify the Architect for instructions as to further action. Failure to do so will make the Contractor liable for any damage arising from construction operations after discovery of these utilities.

3.5 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration until Notice of Completion.

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

END OF SECTION 01 7300

SECTION 01 7330 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section establishes general requirements pertaining to cutting (including excavating), fitting, and patching of the Work.

B. Provide boring, fitting, and patching of the Work, as specified, as indicated, and as needed to:
1. Make the several parts fit properly;
2. Install new work into existing construction.
3. Uncover work to provide for installing, inspecting, or both, of ill-timed work;
4. Remove and replace work not conforming to requirements of the Contract Documents;
5. Remove and replace defective work; and
6. Remove samples of installed work for testing.

C. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

D. Special Requirements:
1. In addition to other requirements specified, upon the Architect's request uncover work to provide for inspection by the Architect of covered work, and remove samples of installed materials for testing.
2. Prior to cutting, notching, or boring of any structural elements, including bearing/shear walls, footings, beams, etc., not specifically detailed in the drawings, obtain approval from the Architect and DSA prior to commencement of work.
3. Do not cut or alter work performed under separate contracts without the Architect's written permission.
4. The Contractor shall provide all encroachment permits or others as required in the right-of-way of any adjacent jurisdiction.

1.2 SUBMITTALS

A. Request for Architect's Consent:
1. Prior to cutting which effects structural safety, submit written request to the Architect for permission to proceed with cutting.
2. Should conditions of the Work, or schedule, indicate a required change of materials or methods for cutting and patching, so notify the Architect and secure his written permission and the required Change Order prior to proceeding.

B. Notices to Architect:
1. Prior to cutting and patching performed pursuant to the Architect's instructions, submit cost estimate to the Architect. Secure the Architect's approval of cost estimates and type of reimbursement before proceeding with cutting and patching.
2. Submit written notice to the Architect designating the time the Work will be uncovered, to provide for the Architect's observation.

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.

PART 2 - PRODUCTS

2.1 MATERIALS

A. For replacement of items removed, use materials complying with pertinent Sections of these Specifications.

2.2 PAYMENT FOR COSTS

A. The Owner will reimburse the Contractor for cutting and patching performed pursuant to a written Change Order, after claim for such reimbursement is submitted by the Contractor. Perform other cutting and patching needed to comply with the Contract Documents at no additional cost to the Owner.

B. For uncovering work and replacement of work for inspection by the Architect:
1. If work is not compliant, Contractor shall pay all costs,
2. If work is compliant, Owner shall pay for removal and replacement as a Change Order.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection: Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, patching, and backfilling. After uncovering the work, inspect conditions affecting installation of new work.

B. Discrepancies: If uncovered conditions are not as anticipated, immediately notify the Architect and secure needed directions. Do not proceed until unsatisfactory conditions are corrected.

3.2 BORING

A. Provide mechanical boring equipment to bore under existing asphalt, concrete, or other surfaces or objects as noted on the drawings. All borings shall be a minimum of 24" under the substrate material unless otherwise authorized by the Architect.

B. Holes shall be bored not to exceed 1" larger diameter than the largest component remaining in the excavation.

C. **Water or air pressure jetting** are not permitted, unless they comply with the following requirements.
1. All surfaces of the hole can be visually inspected with 6' maximum length and,
2. all objects shall be supported continuously to prevent sagging and,
3. the hole shall be filled with compacted damp sand and inspected by the Project Inspector or Materials Testing lab technician.

3.3 PREPARATION PRIOR TO CUTTING

A. Provide required protection including, but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the Work.

B. Provide protection for other portions of the work which may be affected.

C. Provide protection from the elements when needed.

3.4 CUTTING AND REMOVAL - GENERAL

A. Perform required excavating and backfilling as required under pertinent other Sections of these Specifications.
   1. Perform cutting and demolition by methods which will prevent damage to other portions of the Work and provide proper surfaces to receive installation of repair and new work.
   2. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.

B. Remove existing work indicated to be removed, or as needed for installation of new work.

3.5 MATCHING AND PATCHING

A. Where items are removed from existing walls, ceilings, floors, partitions, or roofs to remain, repair walls, ceilings, floors, partitions, roofs, etc., disturbed by removal.

B. Where existing construction is removed, repair abutting walls, ceilings, floors, partitions, or roofs disturbed by removal.

C. Where existing construction is cut or otherwise disturbed to permit installation of new work, match and patch existing disturbed construction.

D. Use methods similar in appearance, and equal in quality to areas and surfaces being repaired.

E. Remove and replace areas, surfaces, or items which cannot be satisfactorily matched or patched.

END OF SECTION 01 7330

SECTION 01 7400 - CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Throughout the construction period, maintain the buildings and site in a standard of cleanliness as described in this Section.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. In addition to standards described in this Section, comply with requirements for cleaning as described in pertinent other Sections of these Specifications.

1.2 QUALITY ASSURANCE

A. Conduct daily inspection, more often if necessary, to verify that requirements for cleanliness are being met.

B. In addition to the standards described in this Section, comply with pertinent requirements of governmental agencies having jurisdiction, including the SWPPP requirements.

C. Contractor shall include the costs of cleaning and trash disposal in his/her bid designate it in the Schedule of Values.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

B. Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General:
1. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.
2. Do not allow accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
4. Provide adequate storage for all items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

3.2 FINAL CLEANING

A. "Clean," for the purpose of this Article, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

B. Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in Article 3.1 above.

C. Site: Unless otherwise specifically directed by the Architect, broom clean paved areas on the site and public paved areas adjacent to the site. Completely remove resultant debris.

D. Structures:
   1. Exterior:
      a. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter visible from 5'.
      b. Remove all traces of splashed materials from adjacent surfaces.
      c. If necessary to achieve a uniform degree of cleanliness, hose down the exterior of the structure.
      d. In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning at no additional cost to the Owner.
   2. Interior:
      a. Visually inspect interior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter visible from 5'.
      b. Remove all traces of splashed material from adjacent surfaces.
      c. Remove paint droppings, spots, stains, and dirt from finished surfaces.
   3. Glass: Clean inside and outside.
   4. Polished surfaces: Apply polish to surfaces requiring routine application of buffed polish as recommended by the manufacturer of the material.

E. Schedule final cleaning as approved by the Architect to enable the Owner to accept a completely clean Work.

3.3 CLEANING DURING OWNER'S OCCUPANCY

A. Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning shall be as determined by the Architect in accordance with the General Conditions of the Contract.

END OF SECTION 01 7400

SECTION 01 7425 - CONSTRUCTION WASTE MANAGEMENT AND CONTROL

PART 1 - GENERAL

1.1 SUMMARY:

A. This section specifies diversion of construction and demolition waste from the landfill. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 01 3110: Additional requirements for project meetings and reports.
3. Section 01 3300: Additional requirements for submittal procedures and project documentation.
4. Section 01 5000: Additional requirements related to trash and waste collection and removal facilities and services.
5. Section 01 6600: Waste prevention requirements related to delivery, storage, and handling.
6. Section 01 7330: Trash/waste prevention procedures related to cutting and patching, installation, protection, and cleaning.
7. Section 31 1000: Handling and disposal of excavated soils and land clearing debris.

C. The following sources may be useful in developing the Waste Management Plan:
1. County engineering or building departments.
2. Sample forms found in “A Guide to the California Green Building Standards Code (Nonresidential)” located at www.bsc.ca.gov/Home/CALGreen.aspx may be used to assist in documenting compliance with the waste management plan.
3. Mixed construction and demolition debris (C&D) processors can be located at the California Department of Resources Recycling and Recovery (CalRecycle).

1.2 SCOPE OF CONSTRUCTION WASTE MANAGEMENT AND CONTROL

A. Intent: Construction waste management and control is intended to achieve the following specific objectives:
1. Generate the least amount of trash and waste possible.
2. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
3. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

B. Construction Waste Management Requirement: Recycle and/or salvage for reuse a minimum of **65 percent** of the nonhazardous construction and demolition waste in accordance with Option 1, 2 or 3 listed below; or meet a local construction and demolition waste management ordinance, whichever is more stringent.
1. Option 1 - Construction waste management plan. (Cal Green Code 5.408.1.1) Where a local jurisdiction does not have a construction and demolition waste management ordinance that is more stringent, submit a construction waste management plan that:
a. Identifies the construction and demolition waste materials to be diverted from disposal by efficient usage, recycling, reuse on the project or salvage for future use or sale.
b. Determines if construction and demolition waste materials will be sorted on-site (source-separated) or bulk mixed (single stream).
c. Identifies diversion facilities where construction and demolition waste material collected will be taken.
d. Specifies that the amount of construction and demolition waste materials diverted shall be calculated by weight or volume, but not by both.

2. Option 2 - Waste Management Company. (Cal Green Code 5.408.1.2) Utilize a waste management company that can provide verifiable documentation that the percentage of construction and demolition waste material diverted from the landfill complies with this section.
3. Option 3 - Waste Stream Reduction Alternative. (Cal Green Code 5.408.1.3) The combined weight of new construction disposal that does not exceed two pounds per square foot of building area may be deemed to meet the 65 percent minimum requirement as approved by the enforcing agency.
4. Documentation: Documentation shall be provided to the enforcing agency which demonstrates compliance with option 1, 2 or 3 above. The waste management plan shall be updated as necessary and shall be accessible during construction for examination by the enforcing agency.

C. Recycling Incentive programs are mandatory for this project; Contractor is responsible for implementation:
1. Any revenue or savings shall accrue to Contractor.
2. Any rebates and credits shall be applied for by Owner and shall accrue to Owner.

D. Owner may decide to pay for additional recycling, salvage, and/or reuse based on Landfill Alternatives Proposal specified below.

E. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
1. Aluminum and plastic beverage containers.
2. Corrugated cardboard.
3. Wood pallets.
4. Clean dimensional wood.
5. Excavated soils and land clearing debris, including brush, branches, logs, and stumps.
6. Concrete.
7. Concrete masonry units.
8. Asphalt paving.
9. Metals, including packaging banding, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
10. Glass.
11. Gypsum board and plaster.
12. Plastic buckets.
13. Carpet, carpet cushion, carpet tile, and carpet remnants.
14. Asphalt roofing shingles.
15. Paint.
16. Plastic sheeting.
17. Windows, doors, and door hardware.
18. Plumbing fixtures.
19. Mechanical and electrical equipment.
20. Fluorescent lamps (light bulbs).
21. Acoustical ceiling tile and panels.

F. Methods of trash/waste disposal that are not acceptable are:
1. Burning on the project site.
2. Burying on the project site.
3. Dumping or burying on other property, public or private.
4. Other Illegal dumping or burying.
5. Incineration either on- or off-site.

G. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.3 DEFINITIONS:

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and nibble resulting from construction, remodeling, repair and demolition operations. Excavated soils and land clearing debris and hazardous or toxic waste are excluded from construction and demolition waste.

C. Hazardous: Exhibiting the characteristics of hazardous substances (i.e., ignitibility, corrosivity, toxicity or reactivity).

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period or exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life In Its Intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.4 SUBMITTALS:

A. General: Submit in accordance with Section 01 3300.

B. Landfill Alternatives Proposal: Within 10 calendar days after receipt of Notice to Proceed, or prior to any trash or waste removal, whichever occurs sooner, submit a projection of trash/waste that will require disposal and alternatives to landfilling, with net costs.
   1. Submit to Architect for Owner’s review and approval.

2. If Owner wishes to implement any cost alternatives, the Contract Sum will be adjusted as specified elsewhere.
3. Include an analysis of trash/waste to be generated and landfill options as specified for Waste Management Plan described below.
4. Describe as many alternatives to landfilling as possible:
    a. List each material proposed to be salvaged, reused, or recycled.
    b. List the proposed local market for each material.
    c. State the estimated net cost resulting from each alternative, after subtracting revenue from sale of recycled or salvaged materials and landfill tipping tees saved due to diversion of materials from the landfill.
5. Provide alternatives to landfilling for at least the materials that cannot be recycled, salvaged, or reused as stated under Waste Management Requirements above.
6. Once Owner has determined which of the landfill alternatives addressed in the Proposal above ore acceptable, prepare and submit Waste Management Plan; submit within 10 calendar days after notification by Architect.

D. Submit Waste Management Plan within 10 calendar days after receipt of Notice to Proceed, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to land filling.

E. Waste Management Plan: Include the following information:
1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
    a. Identify construction waste materials to be diverted from disposal by efficient usage, recycling, reuse on the project or salvage for future use or sale.
2. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
    a. Indicate if construction waste materials will be sorted on-site (source separated) or bulk mixed (single stream).
    b. Indicate how the amount of construction waste materials diverted shall be calculated; by weight or volume, but not both.
    c. Indicate deconstruction, salvage, and recycling strategies and processes.
3. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
4. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
    a. List each material proposed to be salvaged, reused, or recycled.
    b. List the local market for each material.
    c. State the estimated net cost versus landfill disposal.
5. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
7. Recycling Incentives: Describe procedures required to obtain credits, rebates, or similar incentives.

F. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
2. Submit Report on a form acceptable to Owner.

3. Landfill Disposal: Include the following information:
   a. Identification of material.
   b. Amount, in tons or cubic yards of trash/waste material from the project disposed of in landfills.
   c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
   d. Include manifests, weight tickets, receipts, and Invoices as evidence of quantity and cost.
4. Incinerator Disposal: Include the following information:
   a. Identification of material.
   b. Amount, in tons or cubic yards of trash/waste material from the project delivered to Incinerators.
   c. State the identity of Incinerators, total amount of fees paid to Incinerator, and total disposal cost.
   d. Include manifests weight tickets, receipts, and invoices as evidence of quantity and cost.
5. Recycled and Salvaged Materials: Include the following Information for each:
   a. Identification of material, including those retrieved by installer for use on other projects.
   b. Amount in tons or cubic yards, date removed from the project site, and receiving party.
   c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
6. Material Reused on Project: include the following information for each:
   a. Identification of material and how it was used in the project.
   b. Amount, in tons or cubic yards.
   c. Include weight tickets as evidence of quantity.
7. Other Disposal Methods: include information similar to that described above, as appropriate to disposal method.

G. Recycling Incentive Programs:
   1. Where revenue accrues to Contractor, submit copies of documentation required to qualify for incentive.
   2. Where revenue accrues to Owner, submit any additional documentation required by Owner in addition to information provided in periodic Waste Disposal Report.

PART 2 - PRODUCTS

2.1 PRODUCT SUBSTITUTIONS:

A. See Section 01 6200 - Product Requirements for substitution submission procedures.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 6200:
   1. Relative amount of waste produced, compared to specified product.
   2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
   3. Proposed disposal method for waste product.
   4. Markets for recycled waste product.

PART 3 - EXECUTION

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION:

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings; particularly at:
   1. Pre-bid meeting.
   2. Pre-construction meeting.
   3. Regular job-site meetings.
   4. Job safety meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal for use by all contractors and installers.
   1. As a minimum, provide:
      a. Separate area for storage of materials to be reused on site, such as wood cut-offs for blocking.
      b. Separate dumpsters for each category of recyclable.
      c. Recycling bins at worker lunch area.
   2. Provide containers as required.
   3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
   4. Provide materials for barriers and enclosures that ore nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
   5. Locate enclosures out of the way of construction traffic.
   6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   7. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
   8. Keep recycling and trash/waste bin areas neat and clean and dearly marked In order to avoid contamination of materials.

F. Excavated Soils and Land Clearing Debris: 100% of trees, stumps, rocks, and associated vegetation and soils resulting primarily from land clearing shall reused or recycled, except for reuse, either on site or off site of vegetation or soil contaminated by disease or pest infestation.
   1. For a phased project, such material may be stockpiled on site until the storage site is developed.
   2. If contamination by disease or pest infestation is suspected, contact the County Agricultural Commissioner and follow its direction for recycling or disposal of the material.
   3. See www.cdfa.ca.gov/exec/county/county_contacts.html.

G. Hazardous or Toxic Waste: Separate, store, and dispose of hazardous waste according to applicable regulations.

H. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility In order to prevent contamination of recyclable materials.

I. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

J. Salvage: Set aside, sort, and protect products to be salvaged for reuse oft-site.

END OF SECTION 01 7425

SECTION 01 7700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for an orderly and efficient transfer of the completed Work to the Owner.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 01 3300: Submittal procedures.
3. Section 01 4520: Payment procedures for retesting.
4. Section 01 7400: Final cleaning.
5. Section 01 7820: Operation and maintenance data.
6. Section 01 7840: Project record documents.
7. Certifications and Warranties as noted in each specification section.

1.2 QUALITY ASSURANCE

A. Prior to requesting inspection by the Architect, use adequate means to assure that the Work is completed in accordance with the specified requirements and is ready for the requested inspection.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Complete the following prior to requesting inspection for substantial completion.
1. Prepare and submit the list of items to be completed or corrected required by the General Conditions.
2. Closeout Submittals:
a. Prepare and submit an electronic submittal of each closeout submittals including, but not limited to, the following:
i. In-Service Certifications required by Divisions 1 through 33 of the specifications executed by the appropriate persons on form provided in this Section.
ii. Project Asbestos Certification executed by Contractor on form provided in this Section;
iii. Project record documents complying with the requirements of Section 01 7840;
iv. Project Warranty executed by the Contractor on form provided in this Section.
v. Special warranties as specified in Divisions 1 through 33 of the specifications.
vi. Maintenance agreements required by Divisions 1 through 33 of the specifications;
vii. Operation and maintenance manuals required by Divisions 1 through 33 of the specifications complying with the requirements of Section 01 7820;
viii. Manufacturer's recommended cleaning procedures required by Divisions 1 through 33;
ix. Certifications required by Divisions 1 through 33 of the specifications.
x. Test reports required by Divisions 1 through 33 of the specifications.
xi. Final versions of all: submittals, RFIs, bulletins, change order requests and change orders.
b. Upon the Architect’s acceptance of the Closeout Submittal, provide one complete hard copy in 3-ring binders, including “wet-signature” original documents for the Owner’s record.
3. Advise Owner of pending insurance change over requirements.
4. Obtain and submit releases from governmental agencies having jurisdiction enabling the Owner unrestricted use of the Work and access to service and utilities; include occupancy permits, operating certificates, and similar releases.
5. Deliver special tools, spare parts, extra materials, and similar items.
6. Make final change-over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of

change-over in security provisions.

7. Complete start-up testing and balancing of systems, and instruction and demonstration of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
8. Complete final clean-up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
9. Submit a list of subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights, weekends, and holidays.
10. In the presence of the Owner and the Inspector of Record, locate all utility devices required for control, manipulation, or shut-off of building and site utility systems including, but not limited to cleanouts, valves, dampers, valve boxes, pull boxes, handholes, manholes, etc., whether exposed, concealed, or in-ground.

B. Inspection Procedures:
1. Within 5 days of receipt of Contractor's list of items to be completed or corrected, the Architect will make an "initial inspection" and provide the Contractor with an additional list of discrepancies. When the Contractor corrects the items indicated by the Architect and any other, the Contractor shall notify the Architect for the Final Acceptance Inspection.
2. All closeout submittal items as listed in paragraph 1.3.A above shall be completed prior to Notice of Completion being submitted to the Owner for acceptance.

1.4 FUNCTIONAL COMPLETION

A. This level of completion relates to the completion of the construction phase of the commissioning process as described in the following sections and is considered complete when all required documentation has been submitted and approved by the Architect and the Commissioning Agent.
1. Section 01 9113 - General Commissioning Requirements.
2. Section 22 0800 - Commissioning of Plumbing.
3. Section 23 0800 - Commissioning of HVAC Systems.
4. Section 26 0800 - Commissioning of Electrical.

B. All closeout submittal items included in the above references shall be completed prior to Notice of Completion being submitted to the Owner for acceptance.

1.5 FINAL ACCEPTANCE

A. Preliminary Procedures: Prior to requesting final inspection for certification of final acceptance and final payment, prepare and submit the following:
1. Final application for payment with release of liens/stop notices and supporting documentation not previously submitted and accepted.
2. Updated final statement, accounting for final additional changes to the Contract Sum;
3. Final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
4. Final liquidated damages settlement statement, where applicable.
5. Payment by the Contractor of all backcharge items, including but not limited to utilities, materials retesting, and reinspections.
6. Contractor's final verified report, DSA-6C.
7. Contractor shall coordinate switch-over of utilities following Substantial Completion and approval of the Architect. Provide proof of payment for electricity, water, gas and other utilities that are a part of this contract.

B. Inspection Procedures:
1. Within 5 days of receipt of Contractor's written request for Final Acceptance Inspection, the Architect will make a "final inspection" to review the "initial inspection" list of discrepancies and identify any additional discrepancies

discovered.

2. Reinspection: Should the Contractor not have completed the Work as required by the Contract Documents, not have completed the items identified on the list of discrepancies, or should the Architect reject portions of the Work, all further inspections, time expended, and reimbursable expenses incurred by the Architect, his representatives, or consultants for final acceptance will be considered additional services and will be charged at the following rates:
   a. Project Architect: $265/hr or $530.00 per inspection minimum.
   b. Architect's Representative: $185/hr or $370.00 per inspection minimum.
   c. Consultants: The direct cost to the Architect plus 10% or $400.00 per inspection minimum.
3. The Architect will bill Owner for additional services required by the Architect and/or consulting engineers for such additional inspections, time expended, and reimbursable expenses incurred, and Owner shall be reimbursed by deducting the same amount from the final payment.
4. Determination of necessity for such reinspections will be made by consultation between the Owner and the Architect.

END OF SECTION 01 7700

MANGINI

MANGINI ASSOCIATES INC.
4320 West Mineral King Avenue
Visalia, California 93291
(559) 627-0530

www.mangini.us

Specification Section No._____

IN-SERVICE CERTIFICATION

PROJECT:	**PROJECT NAME** Project Address	**DATE:**	
OWNER:		**PROJECT NO.:**	
ARCHITECT:	Mangini Associates Inc.	**DSA FILE NO.:**	
CONTRACTOR:		**DSA APPL. NO.:**	
INSPECTOR:			

IN-SERVICE CONDUCTED BY: _____

MATERIALS REVIEWED (Check applicable boxes)

☐ **RECORD DRAWINGS**	☐ **SAFETY PROCEDURES**	☐ **SHUT DOWN**
☐ **WARRANTIES**	☐ **CLEANING PROCEDURES**	☐ **CONTROLS MANIPULATION**
☐ **MAINTENANCE AGREEMENT**	☐ **IDENTIFICATION SYSTEMS**	☐ **EMERGENCY PROCEDURES**
☐ **OPERATION & MAINTENANCE MANUALS**	☐ **START-UP**	☐ **NOISE/VIBRATION ADJUSTMENT**
☐ **SPECIAL TOOLS AND PARTS**	☐ **CONTROL SEQUENCES**	☐ **EFFECTIVE ENERGY UTILIZATION**

ATTENDEES (Please print name and sign below)

1. DISTRICT FACILITIES REPRESENTATIVE _____

2. SITE REPRESENTATIVE _____

3. DISTRICT MAINTENANCE REPRESENTATIVES _____ (Plumbing) _____ (Mechanical)

_____ (Electrical) _____ (Grounds)

4. OTHERS PRESENT (FOR GENERAL CONTRACTOR, ETC.) _____ _____

_____ _____

MEETING DATE: _____ **TIME OF START:** _____ **TIME OF COMPLETION:** _____

I CERTIFY THAT THE ABOVE NAMED IN-SERVICE COVERED ALL ASPECTS OF THE SPECIALTY FOR WHICH IT WAS CONVENED.

Signature _____ **Date** _____

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4320 West Mineral King Avenue
Visalia, California 93291
(559) 627-0530

www.mangini.us

PROJECT ASBESTOS CERTIFICATION

PROJECT:	**PROJECT NAME** Project Address	**DATE:**	
OWNER:		**PROJECT NO.:**	
ARCHITECT:	Mangini Associates Inc.	**DSA FILE NO.:**	
CONTRACTOR:		**DSA APPL. NO.:**	
INSPECTOR:			

TO: _____

FROM: _____

SUBJECT: **Asbestos Containing Building Materials Letter**

I hereby certify that, to the best of my knowledge, the materials furnished and/or installed by

(General Contractor) _____

or its subcontractors on the (Name of Project) _____

located at (Street Address, City, State) _____

do not contain Asbestos Containing Building Materials.

_____
Date

_____
Contractor

_____
Address

_____

_____

_____
Telephone

_____
Signature of Contractor

_____
Title

MANGINI

MANGINI ASSOCIATES INC.
4320 West Mineral King Avenue
Visalia, California 93291
(559) 627-0530

www.mangini.us

PROJECT WARRANTY

PROJECT:	**PROJECT NAME** Project Address	**DATE:**
OWNER:		**PROJECT NO.:**
ARCHITECT:	Mangini Associates Inc.	**DSA FILE NO.:**
CONTRACTOR:		**DSA APPL. NO.:**
INSPECTOR:		

_____ (Contractor) hereby warrants to the Owner that materials and equipment furnished under the Contract in the (Name of Project) _____
_____
are of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. This warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

If, within 1 year after the date of Substantial Completion of the Work or designated portion thereof, or by terms of an applicable special warranty required by the Contract Documents extending this time period, any of the Work is found to be not in accordance with the requirements of the Contract Documents or proves to be defective in materials or workmanship, the Contractor expressly agrees to correct it, without expense to the Owner, promptly after receipt of written notice from the Owner or his agent to do so unless the Owner has previously given the Contractor written acceptance of the condition. This period of 1 year shall be extended with respect to portions of the Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work. This obligation of the Contractor to correct the Work shall survive acceptance of the Work under the Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

Nothing contained in this warranty shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the time period of 1 year, or special extended time periods required by the Contract Documents, for correction of the Work as described above relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the 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 Work.

In the event of the Contractor's failure to comply with the conditions of this warranty within 10 days after being notified in writing by the Owner or his agent, the Contractor hereby authorizes the Owner to proceed to have said defects repaired and made good at the Contractor's expense and the Contractor will honor and pay the costs and charges therefor upon demand.

The term "Work" means the construction and services required by the Contract Documents and includes all other labor, materials, equipment and services provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or part of the total construction performed under the Contract Documents.

_____ _____
Date Telephone

_____ _____
Contractor Signature of Contractor

_____ _____
Address Title
_____

_____

SECTION 01 7820 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. To aid the continued instruction of operating and maintenance personnel, and to provide a positive source of information regarding products incorporated into the Work, furnish and deliver the data described in this Section and in pertinent other Sections of these Specifications.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Required contents of submittals also may be amplified in pertinent other Sections of these Specifications.

1.2 SUBMITTALS

A. Comply with pertinent provisions of Section 01 3300.

B. Submit an Electronic Submittal preliminary draft of the proposed Manual or Manuals to the Architect for review and comments.

C. Once the Architect has accepted the complete electronic submittal, submit one original hard copy set of binders to the Architect prior to the indoctrination of operation and maintenance personnel.

1.3 QUALITY ASSURANCE

A. In preparing data required by this Section, use only personnel who are thoroughly trained and experienced in operation and maintenance of the described items, completely familiar with the requirements of this Section, and skilled in technical writing to the extent needed for communicating the essential data.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE MANUALS

A. Where instruction Manuals are required to be submitted under other Sections of these Specifications, prepare in accordance with the provisions of this Section.

B. Preliminary Electronic Submittal:
1. Comply with pertinent provisions of Section 01 3300.
2. The submittal shall be one complete .pdf file consisting of all items described in Section 01 7700. Record Documents shall be separately, but similarly submitted in accordance with Section 01 7840.
3. Minimum components:
    a. Neatly typewritten index near the front of the Manual, giving immediate information as to location within the Manual of all emergency information regarding the installation.
        i. Bookmark all .pdf files to match the Project Manual table of contents.
    b. Complete instructions regarding operation and maintenance of all equipment involved including lubrication, disassembly, and reassembly.
    c. Complete nomenclature of all parts of the equipment.
    d. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other data pertinent to procurement procedures.

e. All guarantees and warranties issued.
f. Manufacturers' bulletins, cuts, and descriptive data, where pertinent, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.
g. Such other data as required in pertinent other Sections of these Specifications.

C. Final Hard Copy (Once electronic submittal is accepted):
1. Size: 8-1/2" x 11"
2. Paper: White bond, at least 20 lb weight
3. Text: Neatly written or printed
4. Drawings: 11" in height preferable; bind in with text; foldout acceptable; larger drawings acceptable but fold to fit within the Manual and provide a drawing pocket inside rear cover or bind in with text.
5. Flysheets: Separate each portion of the Manual with neatly prepared flysheets briefly describing contents of the ensuing portion; flysheets may be in color.
6. Binding: Use heavy-duty plastic or fiberboard covers with binding mechanism concealed inside the Manual; 3-ring binders will be acceptable; all binding is subject to the Architect's approval.
7. Measurements: Provide all measurements in U.S. standard units such as feet-and-inches, lbs, and cfm; where items may be expected to be measured within ten years in accordance with metric formulae, provide additional measurements in the "International System of Units" (SI).

D. Provide front and back covers for each Manual, using durable material approved by the Architect, and clearly identified on or through the cover with at least the following information:

OPERATING AND MAINTENANCE INSTRUCTIONS

(name and address of Work)

(name of Contractor)

(general subject of this Manual)

(space for signature of)
(the Architect, and approval date)

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUALS

A. Preliminary:
1. Prepare a preliminary electronic submittal of each proposed Manual.
2. Show general arrangement, nature of contents in each portion, probable number of drawings and their size, and proposed method of binding and covering.
3. Secure the Architect's approval prior to proceeding.

B. Final: Complete the Manuals in strict accordance with the approved preliminary drafts and the Architect's review comments.

C. Revisions:
1. Following the indoctrination and instruction of operation and maintenance personnel, review all proposed revisions of the Manual with the Architect.
2. Following the indoctrination meeting, complete the "In-Service Certification" form and include it as part of the Operation and Maintenance Manual.

3. If the Contractor is required by the Architect to revise previously approved Manuals, compensation will be made as provided for under "Changes" in the General Conditions.

3.2 COMMISSIONING

A. Follow requirements in Section 01 9113, paragraph 3.8, Operation and Maintenance Manuals.

END OF SECTION 01 7820

SECTION 01 7840 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Throughout progress of the Work, maintain an accurate record of changes in the Contract Documents, as described in Article 3.1 below and, upon completion of the Work, transfer the recorded changes to a set of Record Documents, as described in Article 3.2 below.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Other requirements affecting Project Record Documents may appear in pertinent other Sections of these Specifications.

1.2 SUBMITTALS

A. Comply with pertinent provisions of Section 01 3300.

B. The Architect's approval of the current status of Project Record Documents may be a prerequisite to the Architect's approval of requests for progress payment and request for final payment under the Contract.

C. Prior to submitting each request for progress payment, secure the Architect's approval of the current status of the Project Record Documents.

D. Prior to submitting request for final payment, submit the final Project Record Documents to the Architect and secure his approval.

1.3 QUALITY ASSURANCE

A. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved by the Architect.

B. Accuracy of Records:
1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of Drawings and other Documents where such entry is required to show the change properly.
2. Accuracy of records shall be such that future searches for items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.

C. Make entries within 24 hours after receipt of information that the change has occurred.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the Work and transfer of all recorded data to the final Project Record Documents.

B. In the event of loss of recorded data, use means necessary to secure data to the Architect's approval.
1. Such means shall include, if necessary in the opinion of the Architect, removal and replacement of concealing materials.

2. In such case, provide replacements to the standards originally required by the Contract Documents.

PART 2 - PRODUCTS

2.1 RECORD DOCUMENTS

A. Record Documents:
1. Job Set: Promptly following receipt of the Owner's Notice to Proceed, secure from Architect, at no charge to Contractor, one complete set of all Documents comprising the Contract, and post all addenda.
2. Post all requests for information, bulletins, and change orders as they occur.
3. Show all underground utility locations and routings by horizontal and vertical dimension.
   a. Record width of trenches in cases were multiple pipes or conduits are installed.
   b. Record the number and sizes of pipes and conduit where trench combines power, fire alarm, and communications.
4. Show all overhead utility locations and routings by horizontal and vertical dimension.
5. At a time nearing completion of the Work, submit the Job Set to the Architect for review.

B. Preliminary Record Documents Submittal:
1. Make an electronic PDF format color copy of the Job Set and submit to the Architect for review.
   a. Bookmark each sheet with sheet number and title to match the sheet index on the cover sheet of the drawings.

C. Final Record Documents:
1. Upon the Architect’s acceptance of the Job Set, make one complete copy of all sheets, including copies of the backs of sheets used to post record information, and including added sheets used to post record information. This copy shall be submitted to the Architect for distribution to the Owner.
2. Include an electronic PDF format color copy of the accepted Job Set.

PART 3 - EXECUTION

3.1 MAINTENANCE OF JOB SET

A. Immediately upon receipt of the job set described in Paragraph 2.1.A above, identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET", and post all addenda.

B. Preservation:
1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the Job Set to the approval of the Architect.
2. Do not use the Job Set for any purpose except entry of new data and for review by the Architect.
3. Maintain the Job Set at the site of Work as designated by the Architect.

C. Making Entries on Drawings:
1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.
2. Date all entries.
3. Call attention to the entry by a "cloud" drawn around the area or areas affected.
4. In the event of overlapping changes, use different colors for the overlapping changes.

D. Make entries in the pertinent other Documents as approved by the Architect.

E. Conversion of Schematic Layouts:
1. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items, is shown schematically and is not intended to portray precise physical layout.

a. Final physical arrangement is determined by the Contractor, subject to Architect's approval.
b. However, design of future modifications of the facility may require accurate information as to the final physical layout of items which are shown only schematically on the Drawings.

2. Show on the Job Set, by dimension accurate to within one inch, the centerline of each run of items such as are described in subparagraph 3.1.E.1 above.
   a. Clearly identify the item by accurate note such as "cast iron drain", "galv. water", and the like.
   b. Show, by symbol or note, the vertical location of the item ("under slab", "in ceiling plenum", "exposed", and the like).
   c. Make all identification so descriptive that it may be related reliably to the Specifications.
3. The Architect may waive the requirements for conversion of schematic layouts where, in the Architect's judgment, conversion serves no useful purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the Architect.

3.2 FINAL PROJECT RECORD DOCUMENTS

A. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.

B. Method of Showing Changes:
   1. Carefully record change data, coordinating the changes as required.
   2. Clearly indicate at each affected detail and other Drawings a full description of changes made during construction, and actual location of underground and overhead utility locations and routes.
   3. Call attention to each entry by drawing a "cloud" around the area or areas affected.
   4. Make changes neatly, consistently, and with the proper media to assure longevity and clear reproduction.

3.3 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The Contractor has no responsibility for recording changes in the Work subsequent to Final Completion, except for changes resulting from work performed under Warranty.

END OF SECTION 01 7840

SECTION 019113 – GENERAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

B. Owner's Project Requirements, Basis of Design, and Commissioning Plan documentations are included by reference for information only.

1.2 SUMMARY

A. Section Includes:
1. Building commissioning of the following systems:
a. HVAC components and equipment, domestic hot water systems, energy management, control systems.
b. HVAC system: Interaction of cooling, heating, and comfort delivery systems.
c. HVAC Control System: Control hardware and software, sequence of operations, and integration of factory controls.
d. Lighting Control System and interface with daylighting.
e. Water heater Title 24 compliant.
2. Building commissioning activities and documentation in support of the 2022 California Energy Code and 2022 California Green Building Standards Code - CALGreen.
a. Verify that applicable equipment and systems are installed according to the Contract Documents, manufacturer's recommendations, and industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
b. Verify and document proper performance of equipment and systems.
c. Verify that Operation and Maintenance documentation is comprehensive and complete.
3. Verify that Owner's operating personnel are adequately trained.
4. Building commissioning is a process for achieving, verifying, and documenting that the performance of the facilities, systems, and assemblies meet defined objectives and criteria. The commissioning process includes specific tasks to be conducted during each phase in order to verify that design, construction, and training meets the Owner's/Architect's design intent.

B. The Owner, Architect/Engineer, and Commissioning Agent are not responsible for construction means, methods, job safety, or management function related to commissioning on the job site.

C. Related Work Specified Elsewhere (as applicable):
1. SUBMITTAL PROCEDURES
2. CLOSEOUT PROCEDURES
3. OPERATION AND MAINTENANCE DATA
4. PROJECT RECORD DOCUMENTS
5. PLUMBING
6. HVAC/HVAC CONTROLS
7. ELECTRICAL

1.3 DEFINITIONS

A. Acceptance - A formal action, taken by a person with appropriate provider (which may or may not be contractually defined) to declare that some aspect of the Project meets defined requirements; thus permitting subsequent activities to proceed.

B. Basis of Design - The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included.

C. Checklists - Verification checklists that are developed and used during all phases of the commissioning process to verify that the Owner's project requirements are being achieved. This includes checklists for general verification, plus testing, training, and other specific requirements. Various checklists are prepared by the Commissioning Agent and the contractor to document equipment; system test completion.

D. Commissioning - Commissioning is a comprehensive and systematic process to verify that the building systems perform as designed to meet the Owner's requirements. Commissioning during- the construction, acceptance, and warranty phases is intended to achieve the following specific objectives:
   1. Verify and document that equipment is installed and started per manufacturer's recommendations; industry accepted minimum standards, and the Contract Documents.
   2. Verify and document that equipment and systems receive complete operational checkout by installing contractors.
   3. Verify and document equipment and system performance.
   4. Verify the completeness of operations and maintenance materials.
   5. Ensure that the Owner's operating personnel are adequately trained on the operation and maintenance of building equipment.

      The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

E. Commissioning Plan - an overall plan developed by the Commissioning Agent that provides the structure, schedule, and coordination planning for the commissioning process.

F. Control System - A component of environmental, HVAC, security, and fire systems for reporting/monitoring and issuing of commands to/from field devices.

G. Data Logging - The monitoring and recording of flows, currents, status, pressures, etc., of equipment using stand-alone data recorders separate from the control system or the trending capabilities of control systems.

H. Deficiency - A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents, does not perform properly or is not complying with the design intent.

I. Design Intent - A dynamic document that provides the explanation of the ideas, concepts, and criteria that are considered to be very important to the Owner. It is initially the outcome of the programming and conceptual design phases.

J. Functional Performance Test - test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure set point). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing is not functional testing, in the commissioning sense of the word. Test and balancing primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The Commissioning Agent develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual

testing, which is usually performed by the installing contractor or vendor. Functional Performance Tests are performed after pre-functional checklists and startups are complete.

K. Issues Log - A formal and ongoing record of problems or concerns - and their resolution - that have been raised by members of the commissioning team during the course of the commissioning process.

L. Manual Test - using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

M. Monitoring - the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data loggers or the trending capabilities of control systems.

N. Non-Compliance - see Deficiency.

O. Non-Conformance - see Deficiency.

P. Owner's Design Intent (ODI) - A written document that details the functional requirements of a project and the expectations of how it will be used and operated. This includes Project goals, measurable performances criteria, cost considerations benchmarks, success criteria, and supporting information.

Q. Pre-functional Checklist - a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the Commissioning Agent to the contractor. Pre-functional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some pre-functional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The word "pre-functional" refers to before functional testing. Pre-functional checklists augment and are combined with the manufacturer's start-up checklist.

R. Quality Based Sampling - A process for evaluating a subset (sample) of the total population. The sample is based upon a known or estimated probability distribution of expected values; an assumed statistical distribution based upon data from a similar product, assembly, or system; or a random sampling that has scientific statistical basis.

S. Seasonal Performance Tests - Functional Performance Test that are deferred until the system(s) will experience conditions closer to their design conditions based on weather conditions.

T. Simulated Condition - Condition that is created for the purpose of testing the response of a system (e.g.: raising/lowering the set point of a set point of a thermostat to see the response of a VAV box).

U. Startup - The initial starting or activating of dynamic equipment, including completing construction checklists.

V. System Manual - A system focused composite document that includes the operation manual, maintenance manual, and additional information of use to the Owner during the occupancy and operations phase.

W. Procedure - A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems. The test procedures are specified in the Technical Specifications sections on the Contract Documents. Performance testing covers the dynamic functions and operations of equipment and systems under full operation. Systems are tested under various models; such as during low cooling loads, high loads, component failures, unoccupied, varying outside air, fire alarm, power failure, etc. The systems are run through all the sequences state.

X. Training Plan - A written document that details the expectations, schedule, budget, and deliverables of commissioning process activities related to training of project operating and maintenance personnel, users, and occupants.

Y. Trending - The monitoring by a building management system or other electronic data gathering equipment, and analyzing of the data gathered over a period of time. Trending of all equipment control points is required prior to functional testing.

Z. Verification - The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project Requirements.

AA. Warranty Period - Warranty period for the entire project; including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.4 COORDINATION

A. Perform commissioning services to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.

B. Commissioning Agent shall provide overall coordination and management of the commissioning program as specified herein.

C. Commissioning Team: The commissioning process will require cooperation of the Contractor, subcontractors, vendors, installers, Architect/Engineer, Commissioning Agent, and Owner. The commissioning team shall be comprised of the following.
   1. Contractor
      a. Project Manager
      b. Test Engineer
   2. Subcontractors: As appropriate to product or system being commissioned.
   3. Commissioning Agent
      a. Project Manager
      b. Project Engineers
   4. Owner Representative(s)
   5. Architect/Engineer
      a. Architect
      b. MEP Engineers
      c. Specialty Consultant(s)

D. Progress Meetings: Attend construction job-site meetings, as necessary, to monitor construction and commissioning progress. Coordinate with contractor to address coordination, deficiency resolution and planning issues. Plan and coordinate additional meetings as required to progress the work.

E. Site Observations: Perform site visits, as necessary, to observe component and system installations.

F. Functional Testing Coordination:
   1. Equipment shall not be "temporarily" started for commissioning.
   2. Functional performance testing shall not begin until pre-functional, start-up, and test and balancing is completed for a given system.
   3. The controls system and equipment it controls shall not be functionally tested until all points have been calibrated and pre-functional checklists are completed.

1.5 QUALITY CONTROL

A. Qualifications for Commissioning Agents: Engaging commissioning service personnel that specialize in the types of inspections and tests to be performed.
   1. Inspection and testing service agencies shall be members of the Building Commissioning Association (BCA).

1.6 SUBMITTALS

A. Commissioning Agent shall submit the following:
   1. Basis of Design and Design Intent.
      a. Update as necessary during the work to reflect the progress on the components and systems. Forward updates to the Architect/Engineers in a timely manner.
   2. Scoping Meeting Minutes.
   3. Commissioning Plan: Submit within 30 calendar days of authorization to proceed.
      a. Update as necessary during the work to reflect the progress on the components and systems. Forward updates to the Architect/Engineers in a timely manner.
   4. Commissioning Schedule: Submit with Commissioning Plan.
      a. Update as necessary during the work to reflect the progress on the components and systems. Forward updates to the Architect/Engineers in a timely manner.
   5. Functional performance test forms: Submit minimum 30 calendar days prior to testing.
   6. Deficiency Report and Resolution Record: Document items of non-compliance in materials, installation or operation. Document the results from start-up/pre-functional checklists, functional performance testing, and short-term diagnostic monitoring. Include details of the components or systems found to be non-compliant with the drawings and specifications. Identify adjustments and alterations required to correct the system operation, and identify who is responsible for making the corrective changes.
      a. Update as necessary during the work to reflect the progress on the components and systems. Forward updates to the Architect/Engineers in a timely manner.
   7. Final Commissioning Report: Compile a final Commissioning Report. Summarize all of the tasks, findings, conclusions, and recommendations of the commissioning process. Indicate the actual performance of the building systems in reference to the design intent and contract documents. Include completed pre-functional inspection checklists, functional performance testing records, diagnostic monitoring results, identified deficiencies, recommendations, and a summary of commissioning activities.
   8. O&M Submittals:
      a. Training plan: Training plan shall include for each training session:
         Dates, start and finish times, and locations;
         Outline of the information to be presented;
         Names and qualifications of the presenters;
         List of texts and other materials required to support training.
      b. O&M Database.

1.7 RESPONSIBILITIES

A. The general responsibilities of various parties in the commissioning process are provided in this subsection. The specific responsibilities are in the Technical Specifications.

B. All Parties:
   1. Follow all quality requirements in the Contract Documents.
   2. Attend commissioning kickoff meeting and additional coordination meetings as necessary.

C. Architect (A/E):
   Construction Phase
   1. Attend the commissioning coordination meeting and selected commissioning team meetings.

2. Perform normal submittal review, construction observation, as-built drawing review; O&M manual review, etc., as contracted.
3. Provide design narrative documentation to Commissioning Agent.
4. Coordinate resolution of system deficiencies identified during commissioning; according to the Contract Documents.
5. Review and approve the O&M manuals.

D. Mechanical and Electrical Engineers (A/E)

Construction Phase

1. Perform normal submittal review, construction observation, as-built drawing review, etc.; as contracted. One site observation should be completed just prior to system startup.
2. Provide any design narrative and sequences documentation requested by the Commissioning Agent. The engineers shall assist in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings, or equipment documentation is not sufficient for writing detailed testing procedures.
3. Attend the commissioning meetings as necessary.
4. Participate in the resolution of system deficiencies identified during commissioning; according to the Contract Documents.
5. Review and approve the O&M manuals.

Occupancy and Operations Phase

a. Participate in the resolution of non-compliance, non-conformance, and design deficiencies identified during commissioning during warranty period commissioning.
b. Attend lessons learned session.

E. Commissioning Agent: The Commissioning Agent will verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the Owner's Design Intent. When a random sample does not meet the requirement; the Commissioning Agent will report the failure in the "Issues Log".

Construction Phase

1. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications with all necessary parties, frequently updated timelines and schedules and technical expertise.
2. Coordinate the commissioning work and; with the General Contractor and Owner/CM, help integrate commissioning activities into the Master Schedule.
3. Revise the Commissioning Plan as necessary.
4. Plan and conduct a commissioning scoping meeting and other commissioning meetings.
5. Request and review additional information requested to perform commissioning tasks; including O&M materials, contractor startup and checkout procedures.
6. Before startup; gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained in writing to be able to write detailed testing procedures.
7. Review and approve contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the A/E reviews.
8. Write and distribute construction checklists. Prepare and maintain completed construction checklist log.
9. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitution relating to the commissioning process. Assist in resolving any discrepancies.
10. Witness all or part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify owner's project manager of any deficiencies in results or procedures.
11. Approve construction checklist completion by selected site observation and spot-checking.

12. Recommend approval of systems startup by reviewing startup reports and by selected site observation.
13. Review test and balancing execution plan.
14. Oversee sufficient testing of the HVAC control system.
15. Recommend approval of air and water systems balancing by spot testing by reviewing completed reports and by selected sit observation.
16. With necessary assistance and review from installing contractors; write the performance test procedures for equipment and systems; including energy management control system trending, stand-alone data logger monitoring or manual performance testing.
17. Analyze any performance trend logs and monitoring data to verify performance.
18. Coordinate, witness, and recommend approval of manual performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
19. Maintain a master Issues Log and a testing record. Provide the commissioning team with progress reports, test results, and recommended actions.
20. Witness all or part of all Owner contracted tests or tests by manufacturer's personnel over which the Commissioning Agent may not have direct control. Document these tests and include this documentation in Commissioning Record in O&M manuals.
21. Review equipment warranties to ensure that the owner's responsibilities are clearly defined.
22. Oversee and approve the training of the owner's operating personnel.
23. Complete and maintain a commissioning record and building systems book(s).
24. Review and approve the preparation of the O&M manuals.
25. Provide a final commissioning report.
26. Coordinate the development of a systems manual.
27. Prepare a standard trend logging package of primary parameters that will provide the operations staff clear indications of system function in order to identify proper system operation and trouble shoot problems. The Commissioning Agent shall also provide any needed information on interpreting trends.

Occupancy and Operations Phase

a. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
b. Return to the Site/Project on or about 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.
c. Assist in the development of a preventative maintenance plan, a detailed operating plan or an energy and resource management plan or as-built documentation.
d. Attend and facilitate lessons learned session.

F. Owner or Owner's Representative (CM)

Construction and Acceptance Phase

1. Attend a commissioning coordination meeting and other commissioning team meetings.
2. Perform the normal review of contractor submittals.
3. Furnish a copy of all Construction Documents, Addenda, Change Orders, and approved submittals.
4. Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.
5. Provide the Owner's Design Intent documentation to the Commissioning Agent and contractor for information and use.
6. Provide the Basis of Design documents; prepared by the Architect and approved by the Owner to the Commissioning Agent and operation and maintenance training plan.
7. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

Occupancy and Operations Phase

a. Assist the Commissioning Agent as necessary in the seasonal or deferred testing and deficiency correction required by the specifications.
b. Attend lessons learned session.

G. Owner's Project Manager (PM)

Construction Phase

1. Manage the contract of the Architect/Engineer and the General Contractor.
2. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions.
3. Provide final approval for the completion of the commissioning work.

Occupancy and Operations Phase

a. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.
b. Attend lessons learned session.

H. Contractor: Contractor, their subcontractors, and vendors shall assign representatives with expertise and authority to act on their behalf and schedule them to participate in and perform commissioning process activities including, but not limited to the following:

Construction Phase

1. Perform customary quality control on all work performed under this contract.
2. Prepare O&M manuals, as-built drawings, construction observation, etc. according to the Contract Documents; including clarifying and updating the original sequences of operation to as-built/as-tested conditions.
3. Provide startup procedures for all equipment prior to equipment startup/testing.
4. Attend one commissioning coordination meeting at the beginning of construction.
5. Facilitate the commissioning coordination of the commissioning with the construction schedule.
6. Ensure that all subcontractors and vendors execute their installation, testing, and startup responsibilities as defined in this section and the technical specifications.
7. Provide submittals as required elsewhere in the contract including all changes thereto.
8. Participate in intermittent commissioning discussions held during weekly construction meetings.
9. Attend one commissioning meeting to coordinate equipment functional testing approximately 60 days prior to startup of the first piece of major equipment. Meeting will be chaired by the Commissioning Agent and may include various owner representatives including the CM, A/E, and PM.
10. Provide training of owner personnel as identified in contract specifications.
11. Provide trend logs and trend reports of all equipment control points to aid in demonstration of proper control sequence of operations prior to functional testing.

Occupancy and Operations Phase

a. Ensure that subcontractors complete all quality requirements identified in the contract specifications.
b. Ensure that subcontractors correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings as the project progresses.
c. Perform all guarantee work for materials furnished under the contract for the time specified in the contract; including all warranties and curing all latent defects within the time period provided in the contract.

I. Vendors/Subcontractors

1. Analyze specified products and verify that the A/E has specified the newest, most current equipment reasonable for this project's scope and budget.
2. Provide requested information regarding equipment sequence of operation and testing procedures as required in contract specifications.
3. Provide copy of all quality assurance test results/reports for equipment installed by factory representatives.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

A. Instrumentation shall meet the following standards:
   1. Be of sufficient quality and accuracy to test and measure system performance within the tolerances required to determine adequate performance.
   2. Be calibrated on the manufacturer's recommended intervals with calibration tags permanently affixed to the instrument being used.
   3. Be maintained in good repair and operation condition throughout the duration of use on this project.

B. All standard testing equipment required to perform startup, initial system checkout, and required functional performance testing shall be provided by the contractor for the equipment being tested. Any specialized testing equipment not required to perform contract work will be provided by the Commissioning Agent.

C. Data logging equipment or software required to test equipment will be provided by the Commissioning Agent, but shall not become the property of the Owner.

2.2 COMMISSIONING PLAN

A. The Commissioning Agent is to develop a Commissioning Plan identifying the quality assurance processes to be implemented by the Owner. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
   1. Commissioning during construction begins with an initial commissioning meeting conducted by the Commissioning Agent where the commissioning process is reviewed the project commissioning team members.
   2. Additional meetings will be required throughout construction; scheduled by the Commissioning Agent through the Owner or CM with necessary parties attending to plan, scope, coordinate, schedule future activities and resolve problems.
   3. Equipment documentation is submitted to the Commissioning Agent through the Owner or CM during the normal submittal process; including detailed startup procedures.
   4. The pre-functional checklists are to be completed by the contractor prior to startup to demonstrate equipment is ready for startup.
   5. Pre-functional checklists, equipment startup, trend logging and reporting, and test and balancing must be completed before functional performance testing.
   6. Items of non-compliance in material, installation, or setup shall be corrected at no expense to the Owner.
   7. The contractor ensures that the subcontractors' construction checklists are executed and documented and that startup and initial checkout are performed. The Commissioning Agent approving test and balancing, and checklists and startup plans. This also includes witnessing startup of selected equipment. Any testing failure is to be corrected at no additional cost to the Owner, and a re-test is to be performed, observed, and documented.
   8. The Commissioning Agent develops and implements equipment and system performance test procedures. These procedures are approved by the Owner and CM.
   9. The performance tests are executed by the contractor under the direction of the Commissioning Agent with the assistance of the facility staff. All documentation is by the Commissioning Agent.
   10. The Commissioning Agent reviews the O&M documentation for completeness and provides the commissioning record for the O&M manuals.
   11. Commissioning is to be completed before substantial completion.
   12. The Commissioning Agent assists in the development and reviews and pre-approves the training program provided by the contractor.
   13. Deferred testing is conducted as specified or required.

2.3 EQUIPMENT / SYSTEMS TO BE COMMISSIONED

A. The following equipment /systems will be commissioned in this Project:
   1. Domestic water system - plumbing (Level 3)
   2. HVAC ductwork and distribution system (Level 4)
   3. HVAC equipment (Level 4)
   4. HVAC instrumentation (Level 4)
   5. HVAC test and balance (Level 5)
   6. Interior and Exterior Lighting and Controls (Level 3)

Note: Levels defined in 3.4 PERFORMANCE TESTING AND VERIFICATION

PART 3 – EXECUTION

3.1 MEETINGS

A. Commissioning Coordination Meeting - Within 60 days of the Notice to Proceed (NTP), the Commissioning Agent, through the Owner/CM, will schedule, plan, and conduct an initial commissioning meeting. The contractor and its responsible parties previously identified shall attend.

B. Commissioning Agenda Discussions - At various times during the course of construction, commission related agenda will be discussed during the weekly project meetings along with other quality related discussions. These discussions will be held weekly during the final 3 months of construction.

C. Functional Testing Meetings - Prior to HVAC equipment startup a commissioning meeting will be conducted to coordinate commissioning activities with equipment startup and testing.

3.2 COMMISSIONING PROCESS

A. The following activities outline the commissioning tasks and the general order in which they occur.
   1. The Commissioning Agent shall coordinate all activities.
      a. Design Review and Documentation.
      b. Documentation of Basis of Design and Design Intent.
      c. Design Development Review.
   2. Construction Document Review.
   3. Commissioning Scoping Meeting.
   4. Commissioning Plan.
   5. Submittals Review.
   6. Start-Up/Pre-Functional Checklists.
   7. Functional Performance Testing.
   8. Short-Term Diagnostic Testing.
   9. Deficiency Report and Resolution Record.
   10. Operations and Maintenance Training.
      a. O&M Manual.
      b. Training.
      c. O&M Database.
   11. Record Documents Review.
   12. Final Commissioning Report and Documentation.
   13. Deferred Testing.
      a. Unforeseen Deferred Tests.
      b. Seasonal Testing.
      c. End-of-Warranty Review.

3.3 SUBMITTALS

A. The Commissioning Agent will provide appropriate contractors with a specific request for the type of submittal documentation the Commissioning Agent requires facilitating the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum; the request will include the manufacturer and model number, the manufacturer's printed installation and detailed startup procedures, full sequence of operation, O&M data, performance test procedures, trend data, and logs/reports, control drawings, and details of owner contracted tests. In addition; the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the commissioning agent All documentation requested by the Commissioning Agent will be included by the subcontractors in their O&M manual contributions.

B. The Commissioning Agent will review and approve submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the performance of the equipment, and adequacy for developing test procedures. This review is intended primarily to aid in the development of performance and only secondarily to verify compliance with equipment specifications. The commissioning agent will notify the Owner/CM of items missing or areas that are not in conformance with Contract Documents and which require resubmission.

C. The Commissioning Agent may request additional design narrative from the NE and controls contractor, depending on the completeness of the Owner's Design Intent documentation and sequences provided with the plans and specifications.

D. These submittals to the Commissioning Agent do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the contractor; though the Commissioning Agent will review and approve them.

3.4 PERFORMANCE TESTING AND VERIFICATION

A. Requirements - All systems shall be performance tested and verified to demonstrate that each is operating according to the documented design intent and contract documents. Performance testing facilitating bringing the systems from a state of individual equipment level completion to full dynamic system operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
   1. Level 1 - The Commissioning Agent will periodically observe and inspect the installation of the building systems and may review project documentation to verify operational requirements meet the ODI.
   2. Level 2 - The Commissioning Agent will perform Level 1 activities and review inspection reports, test reports, and project deficiency lists prepared by others to verify operational requirements are met.
   3. Level 3 - The Commissioning Agent will perform Level 2 activities and inspect, witness testing, and/or operations of the system to verify operational requirements are met. These activities will be performed independently of the contractor.
   4. Level 4 - The Commissioning Agent will perform Level 2 activities and will witness contractor performance testing of the system. Contractor shall test up to 20% of the system to prove operational requirements are met. The test sections shall be chosen at random by the Commissioning Agent to ensure uniformity of the system. Failure of any test section shall require retesting of that section and an additional test section equivalent in scope. Coordination will be required to avoid impact to the construction schedule.
   5. Level 5 - The Commissioning Agent will perform Level 2 activities and will witness contractor performance testing of the system. Contractor shall test up to 100% of the system to prove operational requirements are met. Failure of any test section shall require retesting of that section. Coordination will be required to avoid impact to the construction schedule.

B. Coordination and Scheduling - The contractor shall provide sufficient notice regarding their completion schedule for the pre-functional checklists, startup of all equipment, test and balancing, and controls systems completion to allow the performance verification to be scheduled. The commissioning team shall oversee, witness, and document the performance of all equipment and systems. The Commissioning Agent in association with the contractor/subcontractors and facility staff shall execute the tests. Performance

verification testing shall be conducted only after the contractor has documented the systems are complete and operational; meeting contract requirements. The control system shall be sufficiently tested and approved by the Commissioning Agent before it is used and trend data/logs and reports provided to verify performance of all components or systems. The air and water balancing shall be completed before performance testing of air or water related equipment or systems. Testing proceeds from components to sub-systems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems shall be checked.

C. Development of Test Procedures - Before test procedures are finalized; the contractor shall provide the A/E and the Commissioning Agent all requested documentation and a current list of changes affecting equipment or systems; program code, control sequences, and testing parameters. Using the testing parameters and requirements in the technical specifications, the Commissioning Agent shall update/develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each contractor/subcontractor or vendor, as appropriate, shall provide assistance to the Commissioning Agent in developing the final procedures. Prior to finalization, the A/E shall review and concur with the test procedure.

D. Test Methods
1. Performance testing and verification may be achieved by manual testing or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data loggers. The Commissioning Agent may substitute specified methods or require an additional method to be executed other than what was specified, with the approval of the Owner/CM. The Commissioning Agent will determine which method is most appropriate for tests that do not have a specified method.
2. Simulated Conditions - Simulating conditions shall be allowed; though timing the testing to experience actual conditions is encouraged whenever practical.
3. Overridden Values - Overriding sensor values to simulate a condition; such as overriding the outside air temperature reading in a control system to be something other than it really is, is acceptable.
4. Simulated Signals - Using a signal generator which creates a simulated signal to test and calibrate transducers and direct digital control constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overridden values.
5. Altering Setpoints - Rather than overriding sensor values; and when simulating conditions is difficult, altering Setpoints to test a sequence is acceptable.
6. Indirect Indicators - Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the test parameters, that the indirect readings through the control system represent actual conditions and responses.
7. Setup - Each performance test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The contractor/subcontractor(s) assisting the Commissioning Agent in executing the test shall provide all necessary materials, system modifications, etc, to produce the necessary flows, pressures, temperatures, etc., necessary to execute the test according to the specified conditions. At completion of the test, the contractor/subcontractor(s) shall return all affected equipment and systems to their approved operating settings.

E. Problem Solving - The burden of responsibility to solve, correct, and retest malfunctions/failures is with the contractor.

3.5 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS

A. Documentation - The Commissioning Agent shall witness and verify/pre-approve the documentation of the results of all functional performance tests.

B. Non-Conformance
1. Corrections of minor deficiencies identified may be made during the tests at the discretion of the Commissioning Agent. In such cases the deficiency and resolution will be documented on the procedure form or on an attached sheet.

2. Cost of retesting a performance test shall be borne by the contractor.
3. The contractor shall submit in writing to the CM at least as often as commissioning meetings are being scheduled. The status of each outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreement and proposals for their resolutions.
    a. The Commissioning Agent retains the original non-conformance forms until the end of the project.
    b. Retesting shall not be considered a justified reason for a claim of delay or for a time extension by the contractor.

C. Approval - The Commissioning Agent notes each satisfactory demonstrated function on the test form. Final approval of the performance test by the Owner is made after review by the Commissioning Agent.

3.6 DEFERRED TESTING

A. Unforeseen Deferred Tests: If a test cannot be completed due to the building structure, required occupancy condition, or other deficiency, the functional testing may be delayed upon recommendation of the Commissioning Agent and the approval of the Owner. These tests are conducted in the same manner as the seasonal tests as soon as possible.

B. Seasonal Testing:
1. Schedule, coordinate, observe, and document additional testing for seasonal variation in operations and control strategies during the opposite season to verify performance of the HVAC system and controls. Complete testing during the warranty period to fully test all sequences of operation.
2. Update O&M manuals and Record Documents (As Built Drawings) as necessary due to the testing.

C. End-of-Warranty Review: Conduct end of warranty review prior to the end of the warranty period. Review the current building operation with the facility maintenance staff. The review shall include outstanding issues from original or seasonal testing. Interview facility staff to identify concerns they may have with building operation. Provide suggestions for improvements and assist owner in developing reports or documentation to remedy problems.
1. Update O&M manuals and Record Documents (As Built Drawings) as necessary due to the testing.

3.7 SYSTEMS MANUAL / OPERATIONS AND MAINTENANCE MANUALS / DATA

A. Commissioning Record and O&M Manuals.
1. The Commissioning Agent will prepare a Systems Manual documenting the commissioning process and identifying operational requirements and parameters for future retesting. The systems manual will include:
    a. O&M manuals prepared by the General Contractor.
    b. The Commissioning Plan.
    c. System reports including design narratives and criteria including sequences. Each system shall contain the startup plan and report, approvals, corrections, construction checklists, completed performance tests, trending and analysis, training plan, and recommended recommissioning schedule.
    d. Final Commissioning Report including an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope, and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the Commissioning Agent regarding the adequacy of the equipment, documentation, and training meeting the contract Documents in the following areas: 1) equipment meeting the equipment specifications, 2) equipment installation, 3) performance and efficiency, 4) equipment documentation and design intent, and 5) operator training. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc., shall also be listed. Each non-compliance issue shall be referenced to the specific performance test, inspection, trend log, etc. where the deficiency is documented. The performance and efficiency section for each piece of

equipment shall include a brief description of the verification method used (manual testing, Building Automation System trend logs, data loggers, etc.) and include observations and conclusions from the testing.

3.8 TRAINING OF OWNER PERSONNEL

A. The contractor shall provide training coordination, scheduling of subcontractors, and ensure that training is completed. All training shall be coordinated through the CM with the Commissioning Agent.

B. The contractor shall ensure that each subcontractor and vendor (mechanical, plumbing, fire, electrical, specialty, etc.) shall have the following responsibilities:
   1. Provide to the Commissioning Agent through the CM a training plan sixty (60) days before the planned training covering the following elements:
      a. Equipment
      b. Intended audience
      c. Location of training
      d. Objectives
      e. Subject covered (description, duration of discussion, special methods, etc.)
      f. Duration of training on each subject
      g. Instructor for each subject
      h. Methods (classroom lecture, manufacturer's quality video, site walk-through. actual operational demonstrations, written handouts, etc.)
   2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment that makes up the system.
   3. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.

END OF SECTION

SECTION 02 3100 - SUBSURFACE UTILITY INVESTIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes investigation and identification of location of overhead, surface, and underground utilities by the Contractor using firm specializing in underground utility verification.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Divisions 1 through 16 of these Specifications.
2. Section 02 4100: Demolition.
3. Section 31 2000: Earthwork.

PART 2 - PRODUCTS

2.1 UTILITY VERIFICATION COMPANIES

A. Use utility verification firm specializing in underground utility location.
1. Off-site utility verification: Underground Service Alert (USA), 800/642-2444.
2. On-site utility verification:
   a. MDR Utility, (559) 827-3713.
3. Verify and stake all on-site utilities with Owner and on-site investigation prior to excavation.

PART 3 - EXECUTION

3.1 INVESTIGATION

A. Prior to demolition, trenching, and earthwork operations, identify location, routing, and elevation of underground utilities in the construction area and along utility trench routings with the Owner.

B. Verify existing utilities with the service providers (i.e., power, telephone, water, sewer, cable TV, etc.) to the point of connection on site (meter, transformer, etc.)

C. Locate underground utilities using electronic detection when available, utility map analysis, and on-site survey.

D. Underground utilities include but are not limited to gas, water, sewer, storm drain, electrical power and signals (fire alarm, telephone, computer, intercom, data), and sprinkler irrigation and controls.

E. Where non-metallic utilities such as storm drain lines are in the work site, snake metallic trace lines through the line prior to electronic detection.

3.2 IDENTIFICATION

A. Identify underground utilities by stakes, flags, and painted lines.

B. Document the invert elevation of all cleanouts, manholes, and drainage structures.

C. Maintain staking and marking of such utilities throughout the duration of the Work.

3.3 COORDINATION

A. Coordinate the proposed routing and elevation of pipes, conduits, and trenches that are part of the Work with existing utilities.

B. Coordinate the routing and elevation of new underground utilities with existing underground utilities. Notify the Architect immediately of any conflicts, prior to proceeding with demolition, trenching, or earthwork operations.

3.4 SITE CONDITIONS

A. Where existing utilities are indicated on the drawings, extreme care shall be exercised in excavating near these utilities to avoid damage, and the Contractor will be held responsible for any damage caused by construction operations.

B. Should utilities not indicated on the drawings be found during construction, the Contractor shall promptly notify the Architect for instructions as to further action. Failure to do so will make the Contractor liable for any damage arising from construction operations after discovery of these utilities.

3.5 UNFORSEEN CONDITIONS

A. Utilities and obstructions not traceable or noted on the Drawings will be considered unforeseen. Should such lines be encountered and damaged, the Contractor shall repair such condition immediately. The cost of repairs will be compensated to the Contractor on a time-and-materials basis by change order.

END OF SECTION 02 3100

SECTION 03 1510 - POST-INSTALLED ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide post-installed anchors where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
   1. Definition: Post-installed anchors are concrete anchors installed in drilled holes after concrete has hardened and includes expansion anchors, screw anchors, and epoxy-type (adhesive) anchors.

B. Related Sections:
   1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to work of this section.
   2. Section 03 3000: Cast-in-place concrete.
   3. Section 05 5000: Metal fabrications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.

B. Product Data:
   1. Submit manufacturer's descriptive literature and product specifications for each product.
   2. Include data to indicate compliance with the specified requirements.
   3. Submit manufacturer's recommended installation procedures.
   4. Submit current ICC research or evaluation reports evidencing maximum allowable shear and withdrawal load data.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility: To ensure consistent quality of anchorage, obtain concrete expansion anchors from a single manufacturer.

B. Manufacturer Qualifications: Provide concrete expansion anchors with current International Code Council Evaluation Service Reports acceptable to the Division of the State Architect, and in conformance with the 2022 California Building Code.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
   1. Hilti KB-TZ2 (ESR 4266).
   2. Simpson Strong-Bolt (ESR-1771).
   3. Hilti HUS-EZ (ESR-3027).
   4. SimpsonTiten HD (ESR-2713).
   5. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Finish: Type 316 stainless steel at exterior applications; zinc-plated at interior applications; mechanically galvanized or type 316 stainless steel when in contact with preservative treated lumber.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages and directions for installation from manufacturer for items to be embedded in concrete construction.

3.2 INSTALLATION

A. Fastening to In-Place Construction (New or Existing Concrete): Provide anchorage devices where necessary for securing designated items indicated on the drawings, or as necessary for a complete and proper job to in-place construction.

B. Install post-installed anchors in strict accordance with the manufacturer's written instructions.

C. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for designated items of construction. Set work accurately in location, alignment and elevation, level true and free of rack, measured from established lines and levels.

D. Concrete shall attain the specified design strength per the contract documents (2,500 psi minimum) prior to installation of post-installed anchors. Adhesive anchors shall be installed into concrete having a minimum age of 21 days at the time of installation. No anchors shall be installed into concrete that is less than 7 days old.

3.3 TESTING AND INSPECTION REQUIREMENTS

A. General Testing Requirements:
1. For verifying satisfactory installation workmanship, an independent testing laboratory shall proof load tests for concrete expansion anchors acting in tension in the presence of the project inspector.
2. If any anchor fails testing, test all anchors of the same type, not previously tested until 20 consecutive anchors pass, then resume the initial test frequency.
    a. If anchors are used for the support and bracing of non-structural components such as pipe, duct or conduit, the 20 consecutive anchors shall be only those anchors installed by the same trade.
3. Continuous Inspection: Continuous inspection shall be provided during installation by project inspector.

B. Testing Frequency:
1. Sill Plate Bolting: Test 10% of anchors.
2. Other Structural Applications: Test all anchors.
3. Non-structural Applications and Equipment Anchorage: Test 50% or alternate bolts in a group, including at least 1/2 of the anchors in each group.
4. Exceptions:
    a. Undercut anchors that allow visual confirmation of full set shall not require testing.
    b. Where the factored design tension on anchors is less than 100 pounds and the anchor is clearly noted on the approved construction documents, only 10% of those anchors shall be tested.
    c. Where adhesive anchor systems are used to install reinforcing dowel bars in hardened concrete, only 25% of the dowels shall be tested if all of the following conditions are met:
        1) The dowels are used exclusively to transmit shear forces across joints between existing and new concrete.
        2) The number of dowels in any one member equal or exceeds 12.
        3) The dowels are uniformly distributed across a seismic force resisting members (such as shear walls, collectors, and diaphragms).

4) Anchors to be tested shall be selected at random by the special inspector.

d. Testing of shear dowels across cold joints in slabs on grade, where the slab is not part of the lateral force-resisting systems shall not be required.

e. Testing is not required for power actuated fasteners used to attach metal tracks of interior non-shear wall partitions for shear only, where there are at least three fasteners per segment of track.

C. Test Loads: Test loads shall be listed in the contract drawings and shall be determined by one of the following methods:

1. Twice the maximum allowable tension load or 1-1/4 times the maximum design strength of anchors as provided in the anchor's ICC-ESR or in accordance with Appendix D of ACI 318.
   a. Tension test load need not exceed 80% of nominal yield strength of anchor element ($0.8A_bF_y$).
2. Tension or torque test values from the table within the contract drawings.

D. Test Acceptance Criteria: Use the ICC-ESR for the anchor installed or the manufacturer's written instructions, acceptable to DSA. Field tests shall satisfy the following minimum requirements:

1. Hydraulic Ram Method: Anchors tested with a hydraulic jack or spring loaded devices shall maintain the test load for a minimum of 15 seconds and shall exhibit no discernible movement during the tension test, e.g. as evidence of loosening of the washer under the nut. For adhesive anchors, where other than bond is being tested, the testing devices shall not restrict the concrete shear cone type failure mechanism from occurring.
2. Torque Wrenched Method: Anchors tested with a calibrated torque wrench must attain the specified torque within 1/2 turn of the nut.
   a. Exceptions:
      1). Wedge or Sleeve type: 1/4 turn of the nut for a 3/8" sleeve anchor only.
      2). Screw Type: 1/4 turn of screw after initial seating of the screw head.

E. Testing Procedure:

1. Testing procedure shall be as required by the manufacturer’s ICC-ESR.
2. Manufacturer’s recommendation for testing may be approved by the enforcing agency, when ICC-ESR does not provide testing procedure.

END OF SECTION 03 1510

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide cast-in-place concrete, including form work and reinforcement, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
   1. The work of this Section includes special precautions to reduce cracking in concrete slabs.
   2. The work of this Section includes special procedures to reduce moisture vapor emissions through interior concrete slabs.

B. Related Sections:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. Section 03 1510: Post-installed Anchors.
   3. Section 07 9210: Joint Sealants.
   4. Section 09 6110: Moisture control treatment for flooring.
   5. Section 31 2000: Earthwork.

C. Special Coordination Requirements: Coordinate with the work of the following sections to identify the finish flooring manufacturer's concrete slab requirements. Such requirements may be over and above the requirements of the Contract Documents and may require additional materials, means, or methods, which shall be included as part of the Work.
   1. Section 03 3450: Polished and dyed concrete flooring.
   2. Section 09 6500: Resilient flooring.
   3. Section 09 6710: Epoxy marble chip flooring.
   4. Section 09 6800: Carpeting.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
   1. Mix Designs: Secure concrete mix designs from the concrete supplier or the testing laboratory in accordance with provisions of Section 01 4520, and submit to the Architect for review and approval. Distribute approved mix designs to testing laboratory, batch plant, job site, and governmental agencies having jurisdiction.
      a. Include a statement clearly indicating the concrete supplier's proposed basis of concrete mix proportions based on ACI 301-16, Section 4.2.3.
      b. When ACI 301-16, Section 4.2.3 is used, strength records used for establishing and documenting concrete mixture proportions shall not be more than 24 months old.
   2. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements for the following:
      a. Vapor barrier.
      b. Curing materials.
      c. Admixtures.
      d. Slip dowel system.
      e. Stair nosings.
      g. Column forms.
      g. Skate board deterrents.
      h. Color additives.
   3. Shop Drawings: Submit shop drawings for the reinforcing steel.
   4. Submit cementitious materials certification to DSA complying with CBC Section 1910A.1.
   5. Submit batch tickets of each load to the Inspector of Record.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with 2022 California Building Code except where more stringent requirements are shown or specified.

B. In accordance with CBC Section 1705A.3.5, do not place concrete until forms and reinforcement have been inspected, all preparations for placement have been completed, and preparations have been checked by the Inspector of Record, all subject to observation of the Architect, Structural Engineer and DSA.

C. Placing Record: In accordance with CBC Section 1705A.3.6, keep a concrete placing record on site recording the time and date of placing the concrete in each portion of the structure. Keep placing record until completion of the structure and make available to the inspection of the Owner, Architect, Structural Engineer, Inspector of Record, and DSA.

D. Field Mock-up: Before performing work of this Section, provide following field mock-up to verify selections made under submittals and to demonstrate aesthetic finish and texture of site concrete, parking lot concrete and fire lane concrete. Approval does not constitute approval of deviations from Contract Documents, unless Architect specifically approves deviations in writing.
   1. Form, reinforce, and cast concrete slab for 3 foot square field mock-up. One mock-up for each finish and texture specified.
   2. Concrete shall be same mix design as scheduled for Project.
   3. Perform placement and finishing work using same personnel as will place and finish concrete for Project.
   4. Mock-up shall be representative of work to be expected.
   5. Approval is for following aesthetic qualities:
      a. Compliance with approved submittals.
      b. Compliance with specified finish and texture.
      d. Compliance with specified color.
   6. Obtain mock-up approval by the Owner, Architect and Project Inspector before starting work on Project.
   7. Unacceptable mock-ups shall be removed from the site and reinstalled until the mock-up is deemed to be in compliance with the project requirements and is acceptable by the Owner, Architect and Project Inspector.
   8. Protect and maintain approved field mock-ups during construction in an undisturbed condition as a standard for judging completed work. Remove mock-up and dispose of materials when no longer required and when directed by the Architect at the end of the project.

1.4 NOTICE CONCERNING SLAB CURLING AND SHRINKAGE CRACKING

A. The Contractor is hereby notified that concrete construction practices and concrete materials can significantly increase the potential for cracking and slab curling, which include the following:
   1. Placement of slabs over high-moisture content subgrade.
   2. Increased mix temperature.
   3. Excessive haul in transit mixture, too long a waiting period at the project site, or too many revolutions at mixing speed.
   4. Use of smaller size aggregate under conditions where larger could have been used.
   5. Use of mixture having high shrinkage characteristics.
   6. Excessive coatings on aggregate due to insufficient washing or contamination during handling.
   7. Use of aggregates of poor inherent quality with respect to shrinkage.
   8. Exceeding the maximum water/cement ratio.

B. The Contractor is responsible for choosing concrete materials and for implementing concrete construction practices which minimize slab curling and shrinkage cracking.

C. Special Concerns:
1. The Contractor is hereby notified that the Work includes basketball, volley ball, tennis, and / or other uses which require minimum joints and minimum curling in the concrete slab playing surface.
2. The Architect has taken normal and customary precautions in the design of the concrete slabs for these uses through the specification of concrete materials, mix, and execution criteria, and through detailing concrete joints and steel reinforcing.
3. The Contractor is responsible to choose concrete materials and implement concrete construction practices which minimize slab curling and shrinkage cracking in these areas of special use.

1.5 INTERNAL MOISTURE REDUCTION

A. Moisture in Concrete Slabs:
1. The Contractor is hereby notified that finish flooring adhesive is extremely sensitive to alkaline solutions (generally pH of 9.0 or greater). Highly alkaline solutions can be formed by moisture vapor within concrete slabs condensing under impermeable flooring materials and combining with alkaline materials naturally occurring in concrete. Impermeable finish flooring materials include sheet vinyl, vinyl composition tile, vinyl-backed carpet, and elastomeric floor systems.
2. The Contractor is hereby notified that concrete construction practices are a major source of moisture within concrete slabs. These practices should be given proper attention to help reduce moisture within concrete slabs:
a. Water/cement ratio too high to provide for proper hydration and densification.
b. Lack of protection of prepared moisture barrier assembly from precipitation.
c. Floating practices which seal the surface of the concrete and prevent proper evaporation of bleed water.
d. Curing practices and admixtures that prevent proper hydration by rushing the process.

B. Contractor's Responsibility:
1. Interior concrete slabs shall meet the requirements of the Contract Documents. The Contractor shall use whatever means and methods are necessary to place and maintain slabs meeting such requirements.
2. Interior concrete slabs shall conform to additional requirements and recommendations of the finish flooring manufacturers.

1.6 SPECIAL WARRANTY

A. Manufacturer's Warranty: In addition to the warranty requirements of the Contract Documents, submit 2 copies of a warranty from the interior slab curing product manufacturer with an extended correction period of **15-years** covering labor and materials to replace or repair floor covering that fails due to moisture migration or moisture-born alkalinity contaminates originating from the concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 FORMS

A. Design, erect, support, brace, and maintain formwork so it will safely support vertical and lateral loads which might be applied until such loads can be supported safely by the concrete structure.

B. Except for metal forms, use new materials. Materials may be re-used during progress of the Work, provided

they are completely cleaned and reconditioned, recoated for each use, and capable of producing formwork of the required quality.

1. Form Facing for Exposed to View Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
2. Chamfer or radius outside corners of beams, joists, columns, and walls.

C. Slip Dowel System: Speed Dowel by Westec Barrier Technologies; #4 rebar dowels x 24" long at 18" on center, minimum of 12" sleeve.

D. Snap Ties: Snap Ties by Dayton/Richmond Concrete Accessories (Constar Supply 559-564-5012), with A-8 Waterseal Washer.

E. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

2.3 MOISTURE BARRIER

A. Capillary Break: 4” of Class 2 aggregate base compacted to 95% relative compaction.

B. Vapor Barrier: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.

1. Acceptable Products:
   a. Stego Wrap 15-mil Vapor Barrier by Stego Industries LLC.
   b. Vaporguard by Reef Industries.
   c. Perminator 15-mil by W.R. Meadows.
   d. Viper Vaporcheck II 15-mil Class A Vapor Barrier by ISI Building Products.
2. Material Properties:
   a. Manufactured from prime virgin resins.
   b. Permeance Rating: ASTM F1249, 0.01 perms or lower.
   c. Permeance after Conditioning: ASTM E154, Sections 8, 11, 12, and 13: Less than 0.01 perms.
   d. Puncture Resistance: ASTM E1709, minimum 2200 grams.
   e. Tensile Strength: ASTM D882, minimum 50.0 lbf/in.
3. Seal Tapes: Manufacturer's recommended tape for sealing seams in the vapor barrier and for sealing the vapor barrier to fresh concrete.
4. Mastic: Manufacturer’s recommended mastic.
5. Accessories: Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer’s instructions..

C. Compactable Slab Base: 3" of granular fill that is compactable, will remain stable, and support construction traffic.

1. Granular fill is defined as a clean, fine grained uniformly-graded material with at least 10% to 30% of particles passing a No. 100 sieve, but not contaminated with clay, silt, or organic material.
2. Expansion Index: < 15
3. The use of clean concrete sand will not be permitted.

2.4 REINFORCEMENT

A. Comply with the following as minimums:

1. Bars: ASTM A615, Grade 40 for #3 bars and smaller, Grade 60 for #4 bars and larger, using deformed bars for #3 and larger.
2. Bending: ACI 318-19, Section 26.6.3.
   a Bars shall be limited to one shop or field bend at any location on the bar.

b. Partially embedded bars shall not be field bent, except as indicated on the Drawings or permitted by the Architect.
c. A bar bent in the incorrect location shall not be straightened; such bars shall be discarded.

B. Fabricate reinforcement to the required shapes and dimensions, within fabrication tolerances stated in ACI 318-19.

C. Do not use reinforcement having any of the following defects:
1. Bar lengths, depths, or bends exceeding the specified fabricating tolerances;
2. Bends or kinks not indicated on the Drawings or required for this Work;
3. Bars with cross-section reduced due to excessive rust or other causes.

D. Shop fusion welded stirrup/tie cages shall be permitted provided they are in conformance with CBC 1903A.8.

E. Global Warming Potential: Concrete reinforcing steel material shall comply with CA Green Building Standards Code Table 5.409.3 and have a maximum acceptable GWP of 1.56 kg CO_2e/MT.

2.5 CONCRETE

A. Portland Cement: ASTM C150, Type II.

B. Fly Ash: May be used as a partial substitute for Portland cement as follows:
1. Fly ash: ASTM C618, Class N or F (Class C is not permitted).
2. Fly ash used may be included in the water/cement ratio calculation.
3. Not more than 20% by weight of fly ash shall be substituted for Portland cement.
4. For concrete with surfaces to be polished, no fly ash in the mixture is allowed.

C. Normal Weight Aggregate: ACI 318 Section 26.4.1.2.1(a).(1) and ASTM C 33, except as modified in CBC Section 1903A.5. Provide aggregates from a single source for exposed concrete.

D. Water: ACI 318-19, Section 26.4.1.4.

E. Admixtures:
1. Do not use calcium chloride admixtures.
2. Admixtures are not permitted without approval from Architect and DSA.

F. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979.
1. Concentration: Base dosage rates on weight of Portland cement, fly ash, and other cementitious materials but not aggregate or sand.
2. Color(s): As indicated on Drawings.
3. Additive Products: Chromix P and Chromix ML by L.M. Schofield Company, (800) 800-9900, or approved equal.

G. Global Warming Potential: Concrete mix shall comply with CA Green Building Standards Code Table 5.409.3 and have the following maximum acceptable GWP:

Concrete, Ready-Mixed		
Concrete Product Category	Maximum GWP Allowed Value	Unit of Measurement
up to 2499 psi	450	kg CO_2e/1 m^3

2500 – 3499 psi	489	kg CO_2e/1 m^3
3500 – 4499 psi	566	kg CO_2e/1 m^3
4500 – 5499 psi	661	kg CO_2e/1 m^3
5500 – 6499 psi	701	kg CO_2e/1 m^3
6500 psi & higher	799	kg CO_2e/1 m^3

Concrete, Lightweight Ready-Mixed		
Concrete Product Category	Maximum GWP Allowed Value	Unit of Measurement
up to 2499 psi	875	kg CO_2e/1 m^3
2500 – 3499 psi	956	kg CO_2e/1 m^3
3500 – 4499 psi	1039	kg CO_2e/1 m^3

2.6 NORMAL WEIGHT CONCRETE DESIGN MIX

A. Proportions: Concrete mix shall be proportioned based on field experience or trial mixtures in accordance with ACI 318-19, Section 26.4.3, and ACI 301-16, Section 4.2.3.
   1. Mix design submittals shall include a statement clearly indicating the concrete supplier's proposed basis of concrete mix proportions through the use of one of the following:
      a. Field experience under ACI 301-16 paragraph 4.2.3.4a, or
      b. Trial mixtures under ACI 301-16 paragraph 4.2.3.4b.
   2. When ACI 301-16, Section 4.2.3 is used as the concrete supplier's proposed basis of concrete mix proportions, strength records used for establishing and documenting concrete mixture proportions shall not be more than 24 months old.

B. Design Professional: A registered civil or structural engineer, licensed in California, with experience in concrete mix design shall select the relative amounts of ingredients to be used as basic proportions of the concrete mixes proposed for use (per DSA IR 17-13).
   1. Mix design submittals shall include the engineer’s stamp and signature.

C. Cement Content: Minimum of 5.5 sacks of cement per cubic yard, unless otherwise noted below.
   1. Minimum of 5.0 sacks of cement per cubic yard for rat slabs.
   2. Off-site concrete shall conform to governing agency standards.

D. Type A Water Reducer (interior slab on grade only): 28.20 oz/cy, plus or minus 20%.

E. Water/Cementitious Material Ratio:
   1. Footings: Maximum of 0.56.
   2. Site Concrete: Maximum of 0.67.
   3. Interior Slabs/Parking Lots/Fire Lanes: Maximum of 0.50.

F. Minimum Compressive Strength:
   1. Footings, interior slabs, parking lots, fire lanes and retaining walls: 3,000 psi at 28 days.
   2. Site Concrete and rat slabs: 2,500 psi at 28 days.
   3. Polished concrete: 3,500 to 4,000 psi at 28 days.

G. Aggregate Gradation Optimization:
1. Workability Factor: 32-42%; **target 35%.**
2. Coarseness Factor: 52-72%; **target 60%.**
3. Fineness Modulus: 2.80 to 3.10.
4. Paste Fraction: 27% plus or minus.
5. Mortar Fraction: Passing the No. 8 sieve.
   a. ¾" to 1" aggregate: 55-57%.
   b. 1-1/2" aggregate: 53-54%.

H. Aggregate Gradation Limits of Combined Mixture:

Sieve Size	% Passing	
	Interior Slabs Parking Lots Fire Lanes 1-1/2"	**Footings Site Concrete Rat Slab Retaining Walls 1"**
2"	100	--
1-1/2"	95-100	100
1"	80-96	94-100
3/4"	65-80	87-99
1/2"	55-65	65-78
3/8"	45-60	55-64
#4	35-50	40-55
#8	25-38	33-43
#16	20-30	19-32
#30	10-20	9-24
#50	2-12	4-12
#100	1-6	1-8
#200	0-4	0-4

I. Slump Limits: Proportion and design mixes for slump at point of placement of 4" plus or minus 1".

J. Concrete Temperature: 90 deg F maximum at time of placement.

K. Ready-Mix Concrete: Comply with ASTM C94, and as herein specified.

2.7 LIGHTWEIGHT CONCRETE DESIGN MIX

A. Proportions: Concrete mix shall be proportioned based on field experience or trial mixtures in accordance with ACI 318-19, Section 26.4.3, and ACI 301-16, Section 4.2.3.
1. Mix design submittals shall include a statement clearly indicating the concrete supplier's proposed basis of concrete mix proportions through the use of one of the following:
   a. Field experience under ACI 301-16 paragraph 4.2.3.4a, or

b. Trial mixtures under ACI 301-16 paragraph 4.2.3.4b.

2. When ACI 301-16, Section 4.2.3 is used as the concrete supplier's proposed basis of concrete mix proportions, strength records used for establishing and documenting concrete mixture proportions shall not be more than 24 months old.

B. Aggregate: Expanded shale, vacuum saturated or thermal quenched; ASTM C330.
1. Maximum Lightweight Aggregate Size: 3/4".

C. Shrinkage Control: Aggregate shall be prepared within 72 hours of being used or be re-wetted for 1/2 hour, twice a day if longer storage is required at the plant.

D. Compressive Strength: 3,000 psi at 28 days. Polished concrete: 3,500 to 4,000 psi at 28 days.

E. Slump Limits: 3" plus or minus 1", measured at the end of the discharge line.

F. Cement Content: Minimum 6.0 sacks of cement per cubic yard.

G. Water/Cement Ratio: 0.50 maximum, measured on free water only.

H. Maximum Lightweight Aggregate Size: 3/4".

I. Entrained Air: 4% to 7%.

J. Weight: 110 pounds per cubic foot, plus or minus 3 pounds.

2.8 TRENCH FILL CONCRETE DESIGN MIX

A. Mix Design:
1. Cement Content: Minimum of 2 sack sand/cement per cubic yard.
2. Minimum Compressive Strength: 1500 psi at 28 days.
3. Aggregate: Meet gradation limits of paragraph 2.6.G, maximum size of 1".

2.9 CURING MATERIALS

A. Interior Slabs with floor covering (resilient flooring and carpet): Concrete surface treatment applied the day of the concrete placement; volatile organic compound (VOC) content rating as required to suit regulatory requirements.
1. Acceptable Products:
a. PMC3300 by Curranseal, www.curranseal.com.
b. VC-5 by Sinak Corporation, www.sinak.com.
c. Synthetics 10S by Synthetic International, www.syntheticsintl.com.

B. Interior Slabs with tile, polished concrete, sealed concrete or bare concrete: Curing blanket, 4 mil white opaque polyethylene laminated over 10 oz. burlap; ASTM C171.

C. Exterior Flatwork on Grade: Clear, Curing compound, colorless, non-yellowing material containing 30% solids content minimum; ASTM C309.
1. Shall not discolor concrete or other materials, shall not leave an oily residue upon evaporation of solvent.
2. Shall afford moisture loss not greater than 0.055 grams/cm^2 at minimum average of 300 square feet.
3. Meet State of California Air Regulation Board Solvent Emission Standards.
4. Curing compounds may not be used on areas to receive traffic coatings unless specifically accepted by the traffic coating manufacturer.

5. Solvent borne acrylic cure and seal products are not acceptable; ASTM C1315.

2.10 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. Expansion Joint Filler: Comply with ASTM D1751 or provide resin-impregnated fiberboard conforming to ASTM D1752.

C. Non-shrink Grout:
1. Factory premixed grout; ASTM C1107.
2. Compressive strength: 7,000 psi at 28 days.

D. Dry Pack Grout: One part Portland Cement to two parts fine sand.

E. Embedded Stair Nosings:
1. Steel Pan Stairs: American Safety Tread Co., Type 820 x 3", Feracast, or approved equal.
2. Poured Concrete Stairs: American Safety Tread Co., Type 801 x 3", Feracast, or approved equal.
3. Install safety treads continuous across full tread width at top and bottom treads of interior stairs treads and at all exterior stair treads, as required by manufacturer and ADA requirements.
4. Color to be contrasting, manufacturers standard colors, approved by Architect.
5. Radius stair nosing where indicated on the Drawings.

F. Underslab Insulation at Walk-in Refrigerator/Freezer:
1. Rigid closed-cell extruded polystyrene foam insulation; ASTM C578, Type VII.
2. Compressive strength: 100 psi, ASTM D1621.
3. Thermal resistance: 5-year aged R-value of 5.4 and 5.0 minimum; F-ft^2-h/Btu^2/inch at 40°F and 75°F respectively; ASTM C518.
4. Water absorption: Max. 0.3% by volume; ASTM C272.
5. Lay boards in two layers of 3" thick boards, staggering joints.
6. Acceptable manufacturer's product: Styrofoam Brand Highload 100 Extruded Polystyrene Foam Insulation by Dow Chemical Company, or approved equal.

G. Skate Board Deterrent: Extruded aluminum clip, 6061-T6 alloy; Skate Stopper, (619) 447-6374; or approved equal.
1. Configuration:
a. 1/2" Radius Corners: Model FA 902.5.
b. Square Corners: Model FA 90A.
c. Chamfer Corners: Model F135.
2. Anchors: Tamper resistant set screw, 5/16-18 x 2", hardened steel, with zinc plating and JS500 coating, set in adhesive filled drilled hole.
3. Finish: Clear anodize.

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.

B. Coordinate with Section 31 2000 – Earthwork prior to placing any concrete.

3.2 MOISTURE BARRIER

A. Installation of Capillary Break:
   1. Prior to placing the rock capillary break, provide trench for all materials laid on the subgrade (i.e. piping and conduits), so that no material will project more than 3/4" above the subgrade.
   2. Evenly spread pea gravel over compacted subgrade.

B. Install vapor barrier in accordance ASTM E1643:
   1. Level and tamp or roll aggregate, sand or tamped earth base.
   2. Install vapor barrier in strict accordance with the manufacturer's written instructions, taping all joints and installing the manufacturer's pipe boots at all penetrating pipes and conduits.
   3. Unroll vapor barrier with the longest dimension parallel with the direction of the pour.
   4. Overlap joints 6" minimum and seal with manufacturer’s tape.
   5. Seal vapor barrier to footings or concrete stemwall per manufacturer’s instructions.
   6. Seal all penetrations (including pipes) per manufacturer’s instructions.
   7. **No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.** Use slab forming and screeding methods and products which do not puncture the vapor barrier.
   8. Repair damaged areas by cutting patches of vapor barrier, overlap damaged area 6", and tape all four sides with tape.
   9. Where ganged conduits are required, bundle with manufacturer’s tape and fill voids with mastic.

C. Installation of Slab Base:
   1. Slab base material is a granular fill that is compactible, easy to trim, and will remain stable and support construction traffic.
   2. Cover vapor barrier with granular fill spread evenly to 3" thickness with a tolerance of +0" / -1" when measured from the bottom of the slab.
   3. Hold granular fill 12" away from exterior walls.
   4. Proof roll granular fill after installation to determine if it is uniformly stable to provide adequate bearing support during and after construction.
   5. **Moisture Content:** Granular fill moisture content shall be **below 6%** at time of concrete placement. If granular fill is saturated prior to placement of concrete, remove the material and replace.
   6. If rain is forecast prior to continuation of slab placement, remove granular fill adjacent to completed slab, cut and fold back vapor barrier over slab and seal to protect from water penetration into granular fill under existing concrete slab. Prior to continuing slab placement, fold back the vapor barrier, provide vapor barrier transition with minimum of 6" lap continuous both sides, replace granular fill and continue with concrete placement.

D. Protection of Installed Slab Base:
   1. Protect all installed slab base construction from precipitation and water penetration by covering and providing positive drainage away from the slab base.
   2. Cover slab openings and blockouts around columns to prevent penetration of water into the slab base and capillary break.

3.3 FORMWORK INSTALLATION

A. Construct forms to the exact sizes, shapes, lines, and dimensions shown, and as required to obtain accurate alignment, location, grades, and level and plumb work in the finished structure.
   1. **Non-Exposed Surfaces:** Where concrete surfaces are not exposed to view, construct formwork conforming to a Class B Surface, Paragraph 4.8.3 of ACI PRC-117.1-14.
   2. **Exposed Surfaces:** Where concrete surfaces are exposed to view, construct forms so that concrete surfaces will have a tolerance of 1/2 of the tolerance limits of a Class A Surface, Paragraph 4.8.3 of ACI PRC-117.1-14.

B. Forms shall be substantial and sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together to maintain position and shape. Forms and their supports shall be designed so as not to damage previously placed structure.
   1. Slab Forming Techniques: Do not puncture the vapor barrier.

3.4 SOIL TREATMENT OF SIDEWALK AND PAVEMENT AREAS WITH HERBICIDES

A. Just prior to placing concrete for pavements and sidewalks, apply herbicide soil treatment at recommended rates for application. Protect desirable vegetation from herbicide treatment.

B. Herbicide shall bear evidence of registration under Federal Insecticide, Fungicide, and Rodenticide Act for weed control application.

3.5 REINFORCING

A. Comply with the following, as well as the specified standards, for details and methods of reinforcing placement and supports.
   1. Clean reinforcement and remove loose dust and mill scale, earth, oil, and other materials which reduce bond or destroy bond with concrete.
   2. Position, support, and secure reinforcement against displacement by forms, construction, and the concrete placement operations. Provide metal chairs, dobies, or other aids manufactured for this purpose.
   3. Place reinforcement to obtain the required coverages for concrete protection.
   4. Reinforcement of site concrete and fire lane paving shall be placed at 2” below the concrete surface unless otherwise shown.
   5. Unless otherwise shown or noted on the Drawings, lap bars as noted on Lap Schedule in structural drawings.
   6. Partially embedded reinforcing shall not be bent without the approval of the DSA.

3.6 EMBEDDED ITEMS

A. Do not embed piping, other than electrical conduit, in structural concrete. See structural drawings for provisions for pipes, sleeves, conduits or other penetrations into or through the footings.

B. Set bolts, inserts, and other required items in the concrete, accurately secured so they will not be displaced, and in the precise locations needed. **IN NO CASE SHALL ANY BOLT OR ANCHOR BE STABBED IN PLACE WHILE OR AFTER THE CONCRETE IS POURED.** Evidence of stabbing will necessitate testing at the expense of the contractor.

C. **Slip Dowel System:** Install in accordance with manufacturer’s written recommendations.

3.7 MIXING CONCRETE

A. Transit mix the concrete in accordance with provisions of ASTM C94.
   1. Water shall only be added at the beginning of discharge and shall be a one-time addition of water. At a minimum, the drum shall be turned an additional 30 revolutions after addition of water. After discharge has begun the addition of water is prohibited.
   2. Discharge of the concrete shall be completed within 90 minutes, or before the drum has revolved 300 times after the cement has been exposed to the mixing water or aggregates.

B. Cold Weather Requirements:
   1. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather. All concrete materials and all reinforcement, forms, fillers, and ground

with which concrete is to come in contact shall be free from frost. Frozen materials or materials containing ice shall not be used.

2. When mixing concrete during freezing or near-freezing weather, the mix shall have a temperature of at least 55 deg F., but not more than 90 deg F. When necessary, concrete materials shall be heated before mixing. Special precautions shall be taken for the protection of transit-mixed concrete.
3. The concrete shall be maintained at a temperature of at least 55 deg F. for not less than 72 hours after placing. After the initial curing period allow the concrete surface to dry prior to exposure. Do not permit the concrete to cool faster than the rate of 5 deg F per hour or more for the first 24 hours.

C. Hot Weather Requirements:
1. During hot weather, proper attention shall be given to ingredients, production methods, handling, placing, protection and curing to prevent excessive concrete temperatures or water evaporation that may impair required strength or serviceability of the member or structure.
2. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

3.8 PLACING CONCRETE

A. Concrete shall not be placed until the forms and reinforcement have been inspected, all preparations for the placement have been completed, and the preparations have been checked by the Inspector of Record, all subject to the observation of the structural engineer or Architect.

B. Preparation:
1. Remove foreign matter accumulated in the forms.
2. Rigidly close openings left in the formwork.
3. Wet wood forms sufficiently to tighten up cracks; wet other material sufficiently to maintain workability of the concrete.
4. Use only clean forms and tools.

C. Conveying: ACI 318-19, Section 26.5.2.1.
1. Concrete shall be conveyed from mixer to place of final deposit by methods that will prevent separation or loss of materials.
2. Conveying equipment shall be capable of providing a supply of concrete at site of placement without separation of ingredients and without interruptions sufficient to permit loss of plasticity between successive increments.
3. Remove rejected concrete from the job site.

D. Placing Concrete in Forms: ACI 318-19, Section 26.5.2.1.
1. Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concreting shall be carried on at such a rate that concrete is at all times plastic and flows readily into spaces between reinforcement.
2. Where concrete is placed in lifts, each lift shall be thoroughly consolidated before the next layer is placed. The rate of placement shall be rapid enough so that previously placed concrete has not yet set when the next lift of concrete is placed upon it. Do not allow flow lines, seams, and planes of weakness (cold joints) to form as a result of placement means and methods.

E. Placing Concrete Slabs:
1. Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
2. Bring slab surfaces to the correct level with a straightedge, and then strike off.
3. Use wood bullfloats or darbies to smooth the surface, leaving the surface free from bumps and hollows.
4. Do not sprinkle water on the plastic surface. Do not disturb the slab surface prior to start of finishing operations.

3.9 CONSOLIDATION

A. All concrete shall be thoroughly consolidated by suitable means during placement and shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms.
   1. Where conditions make consolidation difficult, or where reinforcement is congested, batches of concrete adjusted to use smaller size aggregates shall be used as approved by the structural engineer and the enforcement agency.
   2. Do not vibrate forms or reinforcement.
   3. Do not use vibrators to transport concrete inside the forms.
   4. Perform consolidation by experienced personnel.

3.10 JOINTS

A. Construction Joints (CJ):
   1. Do not use horizontal construction joints except as may be shown on the Drawings.
   2. If additional construction joints are found to be required, secure the Architect's approval of joint design and location prior to start of concrete placement.
   3. Joints shall be constructed in accordance with ACI 318-19, Section 26.5.6.

B. Isolation Joints (IJ):
   1. Do not permit reinforcement or other embedded metal items that are being bonded with concrete (except dowels in floors bonded on only one side of the joints) to extend continuously through any isolation joint, unless specifically noted.
   2. Fill isolation joints full depth with joint material approved by the Architect.
   3. Provide isolation joints as shown on plans.

C. Crack Control Joint (CCJ):
   1. Provide template or guide as required for straight sawcut.
   2. Joints shall be spaced as indicated on the Drawings, but not more than 10'-0" on center.
      a. Joints shall be placed to produce panels that are as square as possible and never exceed a length to width ratio of 1 ½ to 1 – in which case additional joints shall be installed.
   3. Saw cut joints before concrete begins to cool, within 2 to 12 hours after placing.
   4. Use 1/8" thick blade and cut at least 1" deep but not less than one third (1/3) the depth of the slab.

3.11 CONCRETE SLAB FINISHING

A. Finish work shall be performed in accordance with ACI 302.1R-15, Chapter 10.

B. Finished Slab Surfaces: Except as may be shown otherwise on the Drawings, provide the following finishes at the indicated locations:
   1. Scratch Finish: Apply to monolithic slab surfaces that are to receive concrete floor topping or mortar setting bed.
   2. Float Finish: Apply to monolithic slab surfaces that are to receive trowel finish and other finishes specified hereinafter, and to slab surfaces which are to be covered with tile on a setting bed.
   3. Trowel Finish: Apply to interior monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and to slab surfaces that are to be covered with resilient flooring, carpeting, thin-set tile, paint, or other thin-film finish coating system.
   4. Non-slip Broom Finish: Apply to exterior walks, stairs, drives, ramps, and similar pedestrian and vehicular areas. Coordinate required final finish with Architect before application.
      a. Medium broom finish for slopes < 5%.
      b. Heavy broom finish for slopes ≥5%.

C. Finish Concrete Slab Tolerances:

1. Slabs shall be level unless slope is otherwise specified.
2. Tolerances of finished slab surfaces shall comply with ACI 117.1R-14 "Class A Surface Finish Tolerance". Depressions in floor between high spots shall not be greater than 1/8" between a 10' long straight edge.
3. Depressed surfaces shall be leveled with an approved filler and sanded smooth.
4. High spots shall be ground down until level. Remove dislodged aggregate and patch floor.
5. Grind or fill surface defects which would telegraph through applied floor covering systems.
6. Owner reserves the right to test floors and concrete members for conformance to ACI 117.1R-14 Tolerance Specifications by Use of the "Dipstick Floor Profiler". Should tolerances not be within the limits specified, the Contractor shall be required to pay for all testing costs and repairs required to bring materials into compliance.

D. Exterior Flatwork Edge and Joint Finishing:
1. Finish slab edges, including those at formed joints, with an edger having a radius of 1/8".
2. Edge transverse joints prior to brooming. Brooming shall eliminate the flat surface left by the surface face of the edger.
3. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with the properly proportioned mortar mixture and then finished.

E. Required Grinding of Interior Slab:
1. The Contractor shall anticipate that grinding will be required as a result of curling or other slab defects. Grinding required to bring the slab surface into acceptable tolerances for finished flooring installation shall be included as part of the Work.
2. Provide a slip resistant surface after grinding and filling with a 0.6 coefficient of friction at exposed slabs and exterior flatwork.

3.12 CURING

A. ACI 318, Section 26.5.3: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Curing Methods with Surface Applied Curing Products: Apply curing products immediately after concrete finishing in strict accordance with the manufacturer’s written installation instructions.

C. Curing Methods with Curing Blankets:
1. Cure a minimum of 7 days.
2. Provide wet covering of laminated burlap-polyethylene sheets. Lay burlap side down, lap joints 12" minimum and seal penetrations. Keep covering continuously moist, maintaining a film of water on concrete surface at all times. Install sheets in strict accordance with the manufacturer’s written recommendations.
3. Curing shall not be interrupted by removal of the wet covering sheets for any reason during the curing process. No work shall be performed over the curing slabs during the curing process.
4. The concrete shall be maintained above 50 deg F during the curing process.
5. Do not use alternate methods unless specifically approved in writing by the Architect.

D. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Avoid rapid drying at end of final curing period.

E. Protection of Slabs After Curing: After curing is completed, do not allow water to stand on completed slabs. Remove standing water as soon as possible.

3.13 REMOVAL OF FORMS

A. ACI 318, Section 26.11.2.
1. Forms shall be removed in such manner as not to impair safety and serviceability of the structure. All

concrete to be exposed by form removal shall have sufficient strength not to be damaged thereby.

B. No portion of the forming and shoring system may be removed less than 12 hours after placing concrete. When stripping time is less than the specified curing time, measures shall be taken to provide adequate curing and thermal protection of the stripped concrete.
   1. Do not remove shoring until the member has acquired sufficient strength to support its own weight, the load upon it, and the added load of construction.
   2. Do not strip vertical concrete in less than 7 days.

C. Finished Surfaces:
   1. Exercise care in removing forms from finished concrete surfaces so that surfaces are not marred or gouged.
   2. Release sleeve nuts or clamps, and pull the form ties neatly.
   3. Do not permit steel spreaders, form ties, or other metal to project from, or be visible on, any concrete surface except where so shown on the Drawings.

D. Repair of Surface Defects: Repair or replace deficient work at no additional cost to the Owner.
   1. Repair tie holes and other surface defects immediately after formwork removal.
   2. Where the concrete surface will be textured by sandblasting or bush-hammering, repair surface defects before texturing.
   3. Repair tie holes and surface defects to match surrounding concrete color and surface texture.
   4. Repair tie holes and surface defects in conformance with ACI 301-16, Paragraph 5.3.7.

3.14 SURFACE FINISH OF VERTICAL CONCRETE SURFACES

A. Unexposed Form Finish: Rub down or chip off fins or other raised areas.

B. Exposed (to view) Form Finish: Rub down or chip off and smooth fins or other raised areas.
   1. As-Cast Finish: Provide surface finish 3.0 in accordance with ACI 301-16, Paragraph 5.3.3.3.
   2. Rubbed Finish:
      a. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
      b. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
      c. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.
   3. Architectural Finish: Provide architectural finish in accordance with ACI 301-16, Paragraph 6.3.10.
      a. Textured finish using textured forms or form liners.
      b. Exposed aggregate finish using abrasive blast.
      c. Exposed aggregate by removing retarded surface paste on vertical surfaces.
      d. Acid wash.
      e. Mechanical tooling (bush hammering).
      f. Water blast.

3.15 FINISH OF CURBS AND GUTTERS

A. Finish of Curbs and Gutters:
   1. Tool edges of gutter and top of curb with an edging tool to a radius of 1/2"
   2. Float and finish surfaces with a smooth wood float until true to grade, section and uniform in texture.
   3. Brush floated surfaces with a fine-hair brush using longitudinal strokes.
   4. Immediately after removing the front curb form, rub face of curb with wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. While still wet, brush surface in the same manner as the gutter and curb top.

5. Finish the top surface of gutter and entrance drives to grade with a wood float.

3.16 MISCELLANEOUS CONCRETE ITEMS

A. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

B. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.

C. Dry Pack Grout:
1. Pack solid under sill plates where indicated to provide continuous bearing.
2. Provide dry pack prior to installation of roof framing.

D. Skate Board Deterrents: Install deterrent products in accordance with the manufacturer's written installation instructions.
1. Drill and clean anchor holes in concrete.
2. Fill hole approximately 3/4 full with adhesive.
3. Set deterrent and screw set screw into adhesive.

3.17 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. Testing of concrete materials shall comply with Section 01 4520, CBC Chapter 17A, and CBC Section 1910A.

B. The Owner will employ a testing laboratory to perform tests and to submit test reports. Sampling and testing for quality control during placement of concrete may include the following, as directed by the Architect.

C. Compaction and Moisture Testing sub-grade.
1. Test sub-grade immediately prior to placing any concrete or placing a vapor barrier as described in Section 31 2000 – Earthwork.

D. Sampling Fresh Concrete: Comply with requirements of ASTM C172.
1. Slump: ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
2. Concrete Temperature: Test hourly when air temperature is 40 degrees F and below, and when 80 degrees F and above; and each time a set of compression test specimens are made.
3. Compression Test Specimen: ASTM C31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
4. Compressive Strength Tests: ASTM C39; one set for each day's pour, but not less than one set for each 50 cubic yards or each 2,000 square feet of surface area of slabs or walls for each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days; and one specimen retained in reserve for later testing if required.
5. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

E. Batch Plant Inspection:
1. Continuous batch plant inspection during mixing will be required on this project for structural concrete, including but not limited to footings, foundation walls, retaining walls, columns, and floor slabs in compliance with CBC Section 1705A.3.3.
2. Batch plant inspection may be waived in accordance with CBC Section 1705A.3.3.1.

F. Reinforcing Steel Testing **will be required on this project**, except for non-structural concrete work. Comply with CBC Section 1910A.2; testing will be waived if mill certificates are provided.

G. Slab Finish Tolerance Testing: Where requested by the Architect, test slabs for finish tolerance in accordance with ACI 117 Tolerance Specifications by Use of the "Dipstick Floor Profiler".

H. Test Results will be reported in writing to Architect and Contractor within 24 hours that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

I. Non-Destructive Testing: Rebound hammer, sonoscope, or other non-destructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

J. Additional Tests:
   1. The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect.
   2. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.
   3. The Owner shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.
   4. The Owner shall be compensated for such additional testing by deducting the additional costs from the General Contractor’s final payment.

END OF SECTION 03 3000

SECTION 03 3540 - POLISHED AND DYED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide colored and bonded abrasive polished concrete floors using multi-step wet/dry mechanical process where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 03 3000: Cast-In-Place Concrete

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
a. Available dye colors for Architect’s selection.
2. Installation Procedures: Submit manufacturers recommended installation procedures.
3. Installer Qualifications: Submit data for company, principal personnel, experience, and training as specified.

B. Field Quality Control Submittals:
1. Dynamic Coefficient of Friction Test Reports: Submit field quality control reports of testing as specified.
2. Static Coefficient of Friction Test Reports: Submit field quality control report as specified.

C. Contract Closeout Submittals:
1. Submit instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.3 DEFINITIONS

A. Terminology: As defined by Concrete Polishing Council (CPC).

B. Polished Concrete: The act of changing a concrete floor surface, with or without aggregate exposure, to achieve a specified level of gloss.

C. Bonded Abrasive Polished Concrete: The multi-step operation of mechanically grinding, honing, polishing of a concrete floor surface with bonded abrasives to cut a concrete floor surface and to refine each cut to the maximum potential to achieve a specified level of finished gloss as defined by the CPC. This yields the most durable finish and requires the least amount of maintenance.

1.4 QUALITY ASSURANCE

A. Polisher Qualifications:
1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.

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2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress, and is currently certified as Craftsman - Level I or higher by CPC.

B. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.

C. Walkway Auditor: Certified by CPC or NFSI to test bonded abrasive polished concrete floors for dynamic and static coefficient of friction according to ANSI B101.1 and B101.3.

D. Coefficient of Friction: Achieve following coefficient of friction by field quality control testing in accordance to the following standards:
1. ANSI B101.1 Static Coefficient of Friction - Achieve a minimum of .42 for level floor surfaces.
2. ANSI B101.3 Dynamic Coefficient of Friction - Achieve a minimum of .35 for level floor surfaces.

E. Field Mock-up: Before performing work of this Section, provide following field mock-up to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless Architect specifically approves deviations in writing.
1. Form, reinforce, and cast concrete slab for 10 foot square field mock-up.
2. Concrete shall be same mix design as scheduled for Project.
3. Perform placement and finishing work using same personnel as will place and finish concrete for Project.
4. Mock-up shall be representative of work to be expected.
5. Perform grinding, joint filling, honing, and polishing work as scheduled for Project using same personnel as will perform work for Project.
6. Approval is for following aesthetic qualities:
   a. Compliance with approved submittals.
   b. Compliance with specified aggregate exposure.
   c. Compliance with specified finished gloss and Distinctness of Image (DOI) level.
   d. Compliance with specified color.
7. Obtain Architect’s approval before starting work on Project.
8. Protect and maintain approved field mock-ups during construction in an undisturbed condition as a standard for judging completed work.

F. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 01 Sections.
1. Required Attendees:
   a. Owner.
   b. Architect.
   c. Contractor, including supervisor.
   d. Concrete producer.
   e. Concrete finisher, including supervisor.
   f. Concrete polisher, including supervisor.
   g. Technical representative of liquid applied product manufacturers.
   h. Walkway auditor.
2. Minimum Agenda: Polisher shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:
   a. Tour field mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
   b. Review Contract Document requirements.
   c. Review approved submittals and field mock-up.
   d. Review procedures, including, but not limited to:
      1) Section 03 3000 on cast-in-place concrete.
         a) Specific mix design.

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b) Specified curing methods/procedures.
c) Projected 3, 10, and 28 day compression strength test related to specified aggregates exposure for finished floor and project phasing.
d) Protection of concrete substrate during construction and prior to polishing process.
e) Project phasing and scheduling for each step of grinding, honing and polishing operations including, but not limited to:
   i. Quality of qualified personnel committed to project.
   ii. Quality and size of grinders committed to project.
   iii. Proper disposal of concrete slurry and/or concrete dust.
f) Details of each step of grinding, honing, and polishing operations.
   i. Application of color.
   ii. Application of liquid applied products.
   iii. Protecting polished concrete floors after polishing work is complete.

3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.5 FIELD CONDITIONS

A. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished.
   1. Prohibit use of markers, spray paint, and soapstone.
   2. Prohibit improper application of liquid membrane film forming curing compounds.
   3. Prohibit vehicle parking over concrete surfaces.
   4. Prohibit pipe-cutting operations over concrete surfaces.
   5. Prohibit storage of any items over concrete surfaces for not less than 28 days after concrete placement.
   6. Prohibit ferrous metals storage over concrete surfaces.
   7. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces.
   8. Protect from acids and acidic detergents contacting concrete surfaces.
   9. Protect from painting activities over concrete surfaces.

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

PART 2 – PRODUCTS

2.1 LIQUID APPLIED PRODUCTS

A. Lithium Silicate Densifier: A chemical treatment used to enhance the grinding and polishing process of architectural polished concrete surfaces.

B. Micronized Water Borne or Acetone Dye: A translucent dye. Acid stains are not acceptable. Color to be selected by Architect.

C. Stain and Wear Protection: A lithium fortified finish for deep penetration, increased surface hardness and superior reflectivity on concrete.

2.2 ACCESSORIES

A. Repair Material: A product that is designed to repair cracks and surface imperfections. The specified material must have sufficient bonding capabilities to adhere after the polishing to the concrete surface and provide

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abrasion resistance equal to or greater than the surrounding concrete substrate. All repair materials shall be compatible with the liquid applied products.

B. Grout Material: A thin mortar used for filling spaces. Acceptable products shall be:
   1. Epoxy, urethane, polyurea, or polyaspartic resins.
   2. Latex or acrylic binders mixed with cement dust from previous grinding steps.
   3. Silicate binders mixed with cement dust from previous grinding steps.

C. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

D. Joint Filler: A semi-rigid polyurea joint sealant with 100% solids. Metger/McGuire Spal-Pro RS 65 or approved equal.
   1. Clear color unless otherwise required after field mock-up is reviewed.
   2. Hardness, Shore “A” at 70 deg F, ASTM D-2240, Results A64-69.
   3. Tensile elongation at 70 deg F, ASTM D-412, Results 162%.
   4. Tensile strength at 70 deg F, ASTM D-412, Results 393 psi.

2.3 POLISHING EQUIPMENT

A. Field Grinding and Polishing Equipment:
   1. A multiple head, counter rotating, walk behind or ride on machine, of various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete. Excludes janitorial maintenance equipment.
   2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.
   3. If wet grinding, honing, or polishing, use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.

B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.

C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

D. Diamond Tooling: Abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc.) that are attached to rotating heads to refine the concrete substrate.
   1. Bonded Abrasive: Abrasive medium that is held within a bonding that erodes away to expose new abrasive medium as it is used.
   2. Metal Bond Tooling: Diamond tooling that contains industrial grade diamonds with a metallic bonded matrix that is attached to rotating heads to refine the concrete substrate. These tools are available in levels of soft, medium, and hard metallic matrices that are matched with contrasting concrete substrates (i.e. hard matrix/soft concrete, medium matrix/medium concrete, soft matrix/hard concrete) and are typically used in the grinding and early honing stages of the polishing process.
   3. Resin Bond Tooling: Diamond tooling that contains industrial grade diamonds within a resinous bonded matrix (poly-phenolic, ester-phenolic, thermoplastic-phenolic) that is attached to rotating heads to refine the concrete substrate. Resin bond tooling does not have the soft/medium/hard characteristics of metal bond tooling and are typically used for the later honing and polishing stages of the polishing process.
   4. Hybrid Tooling: Diamond tooling that combines metal bond and resin bond that has the characteristics of both types of tooling. These types of tools are typically used as either transitional tooling from metal bond tools to resin bond tools or as a first cut tool on smooth concrete surfaces.

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5. Transitional Tooling: Diamond tooling that is used to refine the scratch pattern of metal bond tooling prior to the application of resin bond tooling in an effort to extend the life of resin bond tooling and to create a better foundation for the polishing process.
6. Abrasive Pad: An abrasive pad, resembling a typical floor maintenance burnishing pad, that has the capability of refining the concrete surface on a microscopic level that may or may not contain industrial grade diamonds. These pads are typically used for the maintenance and/or restoration of previously installed polished concrete flooring.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
   2. Concrete Finished Floor Flatness according to applicable Division 03 Section on cast-in-place concrete.
   3. Concrete curing methods according to applicable Division 03 Section on cast-in-place concrete.
   4. Concrete Compression strength per according to applicable Division 03 Section on cast-in-place concrete.

B. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.

C. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Cleaning concrete surfaces to receive polished and dyed concrete.
   1. Prepare and clean concrete surfaces.
      a. Clear surfaces of any debris and construction materials.
   2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

B. Repair concrete surfaces to receive polished and dyed concrete in accordance with the manufacturer's recommendations.
   1. Verify that substrate is smooth, level, at required finish elevation, and without more than 1/8" in 10'-0" variation from level or slopes shown on the Drawings.
   2. Clean cracks, divots, chips and holes in surface.
   3. Broom clean or vacuum the surfaces to be repaired and polished.
   4. Fill and smooth cracks, divots, chips and holes with repair material.
   5. Do not fill expansion joints, isolation joints, or other moving joints.
   6. Prohibit traffic until repair material is cured and ready to be polished and dyed.

3.3 JOINT FILLING

A. Prepare the joints and Install joint filling materials in accordance with the manufacturer's recommendations. Joint filler shall not be installed prior to 30 days after slab placement.

B. All joints shall be filled after the initial grinding pass but before any subsequent grinding continues.
   1. Should joint filling be required after the polishing process, apply tape or soap to the edge of the concrete to keep the joint filler from staining the concrete.

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2. Fill joints in one pass, 1/2" deep over closed-cell compressible backer rod.

3.4 COLORING CONCRETE FLOORS

A. Dye Application:
1. Auto scrub the surface completely clean and remove any remaining dust. Allow the surface to dry completely before application.
2. Apply using methods and techniques required by manufacturer to produce finish matching approved field mock-ups. Sequence installation with honing / polishing / burnishing and allow it to dry in accordance with the manufacturer's recommendations before proceeding. Apply dye immediately prior to final honing step, unless otherwise indicated by the manufacturer's recommendations.
3. Maintain wet edge, working newly applied solution into edges of adjacent wet edges of previously treated surfaces.
4. Maintain consistent saturation throughout application. Apply dye to rejection.
5. Avoid splashing, dripping, or puddling of solution on adjacent substrates.
6. Remove all rejected dye from the surface using an auto-scrubber.

3.5 POLISHED CONCRETE FLOOR FINISH

A. Final Polished Concrete Floor Finish:
1. Aggregate Exposure Class B – Fine / Sand Aggregate Finish: Remove not more than 1/16 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying fine aggregate with no, or small amount of, medium aggregate at random locations. Also referred to as a "salt and pepper" finish.
2. Finished Gloss Level 1 – Low Gloss Appearance – 400/800 Grit: Determine the gloss level by incorporating a reflective sheen reading between 30 to 40 and Distinctness of Image (DOI) no less than 10 points below the measured gloss level prior to the application of stain and wear protection.

3.6 POLISHING CONCRETE FLOORS

A. Perform all polishing procedures to ensure a consistent appearance from wall to wall.

B. Grinding:
1. Use grinding equipment with metal or semi-metal bonded tooling and sufficient size equipment.
2. Begin grinding with either 18/20 or 30/40 grit diamond tooling (depending on the project conditions) to meet specified aggregate exposure class.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, up to 100/120 grit metal bonded tooling.
    a. Make no fewer than three grit steps between the initial grind and the final 100/120 grind.
    b. Achieve maximum refinement with each pass before proceeding to finer grit tools.
    c. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
4. After the 60/80 grit grinding, treat the surface imperfections.
    a. Mix patching compound or grout material with dust created by grinding operations, grout mix, cement slurry, epoxies, manufacturer's tint, sand or a combination of the above to closely match color of adjacent concrete surfaces.
    b. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.
    c. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

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d. Use grinding equipment and appropriate grit and bond diamond tooling.
e. Apply grout, forced into the pore structure of the concrete substrate, to fill surface imperfections.
f. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
5. Continue grinding until aggregate exposure matches approved field mock-ups.

C. Honing:
1. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
2. Hone concrete in one direction starting with 120/140 grit resin bonded diamond tooling and increasing to 200 grit making as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, up to 400 grit resin bonded diamond tooling reaching maximum refinement with each pass before proceeding to finer grit tooling.
3. Apply dye in accordance with section 3.4 of this specification.
4. Apply liquid densifier and allow it to dry in accordance with the manufacturer's recommendations before proceeding.
5. Hone concrete in one direction with 400 grit resin bonded diamond tooling and make as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, reaching maximum refinement with each pass before proceeding.

D. Burnishing (Finished Gloss Level 1 – Low Gloss Appearance – 400/800 Grit):
1. Dry mop floor clean to remove all debris after each pass.
2. Burnish concrete in one direction with 400 grit diamond impregnated pad and make as many sequential passes as required, each pass perpendicular to previous pass, reaching maximum refinement with each pass before proceeding.
3. Apply stain and wear protection and allow it to dry in accordance with the manufacturer's recommendations before proceeding.
4. Burnish concrete in one direction with 400 grit diamond impregnated pad and make as many sequential passes as required, each pass perpendicular to previous pass, reaching maximum refinement with each pass before proceeding.
5. Apply stain and wear protection and allow it to dry in accordance with the manufacturer's recommendations before proceeding.
6. Burnish concrete in one direction with 800 grit diamond impregnated pad and make as many sequential passes as required, each pass perpendicular to previous pass. Burnish to uniform reflective sheen matching approved field mock-up.

3.7 FIELD QUALITY CONTROL

A. Field Testing: Installing contractor shall engage a qualified walkway auditor, under review of the Project Inspector, to perform field testing and submit reports for record to determine if polished concrete floor finish complies with the following:
1. ANSI B101.1 for specified static coefficient of friction.
2. ANSI B101.3 for specified dynamic coefficient of friction.
3. ASTM D523 for specified gloss level (Reflective Sheen Reading).
4. ASTM D5767 for specified gloss level (Distinctness of Image Reading).

B. Vapor Testing Concrete Floors (prior to commencing work of this section):
1. Moisture Vapor Transmission Rate:
a. Test Method: Perform anhydrous calcium chloride test according to ASTM F 1869.
b. Acceptable Results: Not more than 5 pounds per 1000 square feet in 24 hours.

2. Relative Humidity:

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a. Test Method: Perform relative humidity test using in situ probes according to ASTM F 2170.
b. Acceptable Results: Not more than 80 percent.

3.8 CLOSEOUT ACTIVITIES

A. Maintenance Training: CPC Craftsman shall train Owner's designated personnel in proper procedures for maintaining polished concrete floor.

3.9 PROTECTION

A. Covering: After completion of polishing, protect polished floors from subsequent construction activities with protective covering.

END OF SECTION 03 3540

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SECTION 04 2900 - REINFORCED UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Provide reinforced unit masonry where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division I of these Specifications.
2. Section 01 4520: Testing and inspection requirements.
3. Section 07 1900: Water repellant coatings.
4. Section 07 9210: Joint Sealants.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.
3. Shop Drawings: Submit shop drawings for the reinforcing steel.
4. Mill Certificates: Submit steel producer's certificates of mill analysis, tensile and bend test for reinforcement steel required for project.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 6600.

B. Store masonry units above ground on level platforms which allow air circulation under the stacked units.

C. Cover and protect against wetting prior to use.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 CONCRETE MASONRY UNITS

A. Provide lightweight hollow load-bearing concrete masonry units complying with ASTM C90 in dimensions as indicated on the Drawings.
1. Where dimensions are not indicated on the Drawings, provide units having nominal face dimensions of 16" long by 8" high by the depth shown or otherwise required.
2. Provide accessory shapes as indicated or otherwise required.
3. Color and Texture: As indicated on the Finish Schedule or selected by the Architect.

2.3 REINFORCEMENT AND ACCESSORIES

A. Bars: ASTM A615, Grade 40 for #3 bars and smaller, Grade 60 for #4 bars and larger, using deformed bars for #3 and larger.

B. Fabricate reinforcement in accordance with recommendations contained in CRSI "Manual of Standard Practices."

C. Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.

2.4 MORTAR

A. Portland Cement: ASTM C150, Type II.

B. Lime: Hydrated lime, ASTM C207.

C. Aggregate: Clean, sharp, well graded aggregate free from injurious amounts of dust, lumps, shale, alkali, surface coatings, and organic matter; ASTM C144.

D. Admixtures: Do not use admixtures unless specifically approved by DSA and the Architect.

E. Water: Provide water free from deleterious amounts of acids, alkalis, and organic materials.

F. Mortar Mixing:
1. Compressive Strength: Minimum 1800 psi at 28 days.
2. Cement-Lime Mortar Proportions: Type S; ASTM C270.
   a. Add lime to mixer last.
   b. Measure materials in suitable calibrated devices. Shovel measurements will not be accepted.
3. Mechanically mix in a batch mixer for not less than three minutes, using only sufficient water to produce a mortar which is spreadable and of a workable consistency.
4. Re-temper mortar with water as required to maintain high plasticity.
   a. On mortar boards, re-temper only by adding water within a basin formed with mortar, and by working the mortar into the water.
   b. Discard and do not use mortar which is unused after 1-1/2 hours following initial mixing.

2.5 GROUT

A. Portland Cement: ASTM C150, Type II.

B. Aggregate: Clean, sharp, well graded aggregate free from injurious amounts of dust, lumps, shale, alkali, surface coatings, and organic matter; ASTM C404.

C. Admixtures:
1. Low Lift Grouting: Do not use admixtures for low lift grouting unless specifically approved by DSA and the Architect.
2. High Lift Grouting: Sika Grout Aid, or other DSA approved admixture. Submit alternatives not less than 30 days prior to beginning grouting.

D. Water: Provide water free from injurious amounts of acids, alkalis, and organic materials.

E. Grout Mixing:
1. Provide "fine grout" or "coarse grout" in locations required by CBC Section 2103A.3. Provide coarse grout in spaces 2" or more in width and in all filled-cell masonry construction.
2. Compressive Strength: Minimum of 2000 psi at 28 days.
3. Proportions: ASTM C476.

4. Adjust water content to provide proper workability and ensure proper placement without segregation under field conditions. Water content, expressed on a saturated surface-dry basis, shall not exceed 0.7 times the weight (mass) of cement.
5. Course Grout: Combine coarse and fine aggregates such that the fine aggregate part is not greater than 80% of total aggregate weight (mass) and at least 90% shall pass the 1/2" sieve.

2.6 BOLTS AND ANCHORS

A. **In no case shall any bolt or anchor be stabbed in place during or after the grouting**. Provide templates or other means to secure embeds during the grouting process.

B. Bent bar anchor bolts are not permitted in masonry construction; use headed bolts only.

2.7 ACCESSORY MATERIALS

A. Joint sealant and backing: Refer to Section 07 9210 – Joint Sealants.

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 ENVIRONMENTAL CONDITIONS

A. Do not place masonry units when air temperature is below 40 degrees F.

B. Protect masonry construction from direct exposure to wind and sun when erected in ambient air temperature of 99 degrees F in the shade, with relative humidity less than 50%.

3.3 INSTALLATION

A. Do not commence installation of the work of this Section until horizontal and vertical alignment of foundation is plumb and square.
   1. Lay only dry masonry units.
   2. Use masonry saws to cut and fit masonry units.
   3. Set units plumb, true to line, with level courses accurately spaced; comply with tolerance limits of ACI 530.1-13, 3.3.G. Failure to comply with tolerances will be cause for rejection of work.
   4. Clean the top surface of foundation free from dirt, debris, and laitance, and expose the aggregate by blast cleaning prior to start of installing first course.
   5. Accurately fit the units to plumbing, ducts, openings, and other interfaces, neatly patching all holes.
   6. Keep walls continually clean, preventing grout and mortar stains. If grout does run over, clean immediately.
   7. Do not use chipped or broken units. If such units are discovered in the finished wall, the Architect may require their immediate removal and replacement with new units at no additional cost to the Owner.

B. Laying Up:
   1. Build reinforced hollow-unit masonry to preserve the unobstructed vertical continuity of the cells to be filled. All head joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells.
   2. Fully bed walls and cross webs forming such cells in mortar to prevent leakage of grout.

3. Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear, unobstructed, continuous vertical cell measuring not less than 2" x 3", except the minimum cell dimension for high-lift grout shall be 3".
4. At the time of laying, all masonry units shall be free of dust and dirt.
5. Tooling: Tool joints to a dense, smooth surface.

C. Coursing:
1. Establish lines, levels, and coursing indicated; protect from displacement.
2. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
3. Bond: Running.
4. Coursing: One unit and one mortar joint to equal 8".
5. Mortar Joints: Concave.

3.4 REINFORCING

A. Embed all reinforcing and wire ties in the grout. The clear space between masonry unit surfaces and reinforcing shall be a minimum of 1/2" for coarse grout.

B. Place horizontal reinforcement in bond beam units with a minimum grout cover of 1" above steel for each grout pour. The depth of the bond beam channel below the top of the unit shall be a minimum of 1-1/2" and the width shall be 3” minimum.

3.5 CONDUITS AND PIPES IN MASONRY WALLS

A. Conduits up to 3/4" in diameter will be allowed in cells for vertical runs only. No horizontal runs are allowed except that vertical offsets between adjacent cells will be allowed to avoid interference and congestion with reinforcing steel and other embedded items.

B. Water, gas and other pipes may penetrate through a wall in a sleeve, but shall not be embedded in walls.

C. Reinforcing Cells: Limit conduit to one 3/4" diameter conduit per cell, provided the following conditions are maintained:
1. Reinforcing steel shall be properly placed and shall not be relocated to accommodate conduit.
2. Grout cover between conduit and reinforcing steel shall be 2.5 times the bar diameter with 1-1/2" minimum (1-1/2" at #5 bars, 1-7/8" at #6 bars).
3. Maintain a minimum clear area within cell of 3" by 3" for consolidation by vibration.

D. Unreinforced Cells: Limit conduit to two 3/4" diameter conduit or one 1" diameter conduit per cell, provided the following conditions are maintained:
1. Conduit shall not be placed closer than 3 diameters, center to center, to adjacent conduit.
2. Maintain minimum clear area within the cell of 3" by 3" for consolidation by vibration.

3.6 GROUTING

A. Perform grouting in strict accordance with CBC Section 2104A.
1. Solidly fill all cells.
2. Consolidate grout at time of pour by puddling with a mechanical vibrator, filling all cells of the masonry, and then reconsolidating later by puddling before the plasticity is lost.
3. Provide workable mix suitable for placing without segregation and thoroughly mix.
4. Place grout by pumping or an approved alternate method. Place before initial set or hardening occurs.
5. Consolidate grout by mechanical vibration during placing and reconsolidate after excess moisture has been absorbed, but before workability is lost.

6. The grouting of any section of a wall shall be completed in one day, with no interruptions greater than one hour.

B. Low-Lift Grouted Construction:
1. Units shall be laid a maximum of 4'-0" before grouting, and all overhanging mortar and mortar droppings shall be removed.
2. Grouting shall follow each 4'-0" of construction laid and shall be consolidated so as to completely fill all voids and embed all reinforcing steel.
3. When grouting is stopped for one hour or longer, horizontal construction joints shall be formed by stopping the pour of grout not less than 1/2" nor more than 2" below the top of the uppermost unit grouted.
4. Horizontal steel shall be fully embedded in grout in an uninterrupted pour.

C. High-Lift Grouted Construction:
1. Where high-lift grouting is used, the method shall be approved by the enforcement agency. Submit complete specifications to Architect prior to starting construction; CBC Section 2104A.1.3.1.1.1.2 and DSA IR 21-2.
2. Cleanout openings shall be provided at the bottom of each pour of grout at all cells.
3. Any overhanging mortar or other debris shall be removed from the insides of cell walls. The foundation or other horizontal construction joints shall be cleaned of all loose material and mortar droppings before each pour. The cleanouts shall be sealed before grouting.
4. An approved admixture that reduces early water loss and produces an expansive action shall be used in the grout.
5. Grout lifts shall be limited to 4'-0" in height, or 5'-0" with written approval from DSA.

3.7 CAULKING

A. Seal all expansion and control joints. Refer to Section 07 9210 – Joint Sealants.

3.8 QUALITY CONTROL TESTING AND INSPECTION DURING CONSTRUCTION

A. The testing and inspection of masonry materials shall be in compliance with Section 01 4520 - Testing and Special Inspection Services, CBC Chapter 17A, and CBC Section 2105A.

B. The Owner will employ a testing laboratory to perform tests and to submit test reports. Sampling and testing for quality control during placement of masonry may include the following, as directed by the Architect.

C. Inspections: All masonry work shall be performed only in the presence of the special masonry inspector.

D. Manufacturer shall clearly identify and tag each pallet of material to simplify identification by materials testing lab.

E. Mortar and Grout Compression Tests:
1. Sample and test mortar specimens per ASTM C1586
2. Sample and test grout specimens per ASTM C1019.
3. Frequency: At the beginning of masonry work, take at least 1 test sample of mortar and grout on 3 successive working days, and take additional samples at least 1 week intervals thereafter. Take additional samples whenever any change in materials or job conditions occurs, or whenever in the judgement of the Architect or DSA such tests are necessary.

F. Masonry Unit - Unit Strength Method:
1. Sample and test units, mortar, and grout to show compliance with the compressive strength required in CBC 2105A.
2. Comply with "Unit Strength" or "Prism Test" method.

G. Masonry Core Tests: Take masonry core tests in compliance with CBC Section 2105A.4; not less than 2 cores from the project and at least 1 core from each building for every 5,000 square feet of the greater of the wall area or the floor area or fraction thereof.

H. Test Results will be reported in writing to Architect and Contractor within 24 hours that tests are made.

I. Reinforcing steel testing **will be required on this project**; CBC Section 1910A.2; provide mill certificates.

3.9 CLEANING

A. Inspection and Adjustment:
   1. Upon completion of the work of this Section, make a thorough inspection of installed masonry and verify that units have been installed in accordance with the provisions of this Section.
   2. Make necessary adjustments.

B. Clean surfaces of masonry as required for proper application of the specified finishes.

C. Provide light (whip clean) sandblast of all exposed CMU as specified in Section 03 3500. Protect adjacent surfaces.

END OF SECTION 04 2900

SECTION 05 1200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide structural steel as shown on the Drawings, specified herein, and needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 01 4520: Testing and inspection requirements.
3. Section 05 5000: Metal fabrications.
4. Section 09 9100: Field painting of steel members.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Provide producers' or manufacturers' specifications and installation recommendations for the following products, including laboratory test reports and other data required to prove compliance with the specified requirements.
a. Structural steel, including certified copies of mill test reports covering chemical and physical properties;
b. High strength bolts, including nuts and washers;
c. Unfinished bolts and nuts;
d. Structural steel primer paint.
2. Shop Drawings: Provide shop drawings including complete details and schedules for fabrication and shop assembly of members.
a. Include details of cuts, connections, camber, holes, and other pertinent data;
b. Indicate welds by AWS symbols, and show size, type, and length of weld;
c. Provide setting drawings, templates, and directions for installing anchor bolts and other required anchors;
d. Identify details by reference to sheet and detail number of the Drawings.

1.3 QUALITY ASSURANCE

A. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedures" and CBC Section 2204A.1.

B. Codes and Standards: Comply with provisions of the following:
1. California Building Code, 2022 Edition.
2. AISC 360-16.
3. AISC 341-16.
4. Global Warming Potential: Steel material shall comply with CA Green Building Standards Code Table 5.409.3 and have a maximum acceptable GWP for the following:
a. Hot-rolled structural steel sections: 1.77 kg CO_2e/MT.
b. Hollow structural sections: 3.00 kg CO_2e/MT.
c. Steel plate: 2.61 kg CO_2e/MT.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 6600.

B. Delivery and Storage:
1. Deliver materials to the job site properly marked to identify the location for which they are intended.
2. Use markings corresponding to markings shown on the approved Shop Drawings.
3. Store in a manner to maintain identification and to prevent damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Wide Flanges: ASTM A992, Grade 50.

C. Rolled Steel Shapes, Plates, and Bars: ASTM A36, or ASTM A572 Grade 50 where indicated on structural drawings.

D. Steel Pipe: ASTM A53, Type E or S, Grade B, and where applicable, API-5L, Grade B.

E. Steel Tube: ASTM A500, Grade C.

F. Anchor Bolts: ASTM F1554, Grade 36, headed type with heavy hexagonal nuts unless otherwise indicated.

G. Unfinished Threaded Fasteners:
1. ASTM A307, grade A, regular low carbon steel bolts and nuts.
2. Provide either hexagonal or square heads and nuts; except use only hexagonal units for exposed connections.

H. Electrodes for Welding: E-70XX; AWS standards.

I. High Strength Threaded Fasteners: Provide heavy hexagonal structural bolts, heavy hexagonal nuts, and hardened washers, all from quenched and tempered medium carbon steel; ASTM A325.

J. Automatic End Welded Studs: Nelson Granular Fluxfilled Shear Connector or anchor studs or approved equivalent manufactured of C-1015 cold rolled steel; ASTM A108.

K. Steel Rod: Mild carbon steel, weldable quality.

2.2 PAINT

A. Primer: 10-99 by Tnemec or No. 5269 by Rustoleum.

2.3 GROUT

A. Grout: Non-shrink, non-metallic aggregate type, ASTM C1107; capable of developing a minimum compressive strength of 7,000 psi at 28 days.

2.4 FABRICATION

A. Shop Fabrication and Assembly:
1. Fabricate items of structural steel in accordance with AISC specifications.
2. Properly mark and match-mark materials for field assembly and for identification as to location for which intended.
3. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
4. Where finishing is required, complete the assembly, including welding of units, before start of finishing operations.
5. Provide finish surfaces of members exposed in the final structure free from markings, burrs, and other defects.

B. Connections:
1. Provide bolts and washers of types and sizes required for completion of field erection.
2. High Strength Bolted Construction:
a. Install high strength threaded fasteners in accordance with AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts."
b. Use A325N bolts unless noted otherwise.
c. Use A325 SC bolts at moment connections and where indicated on the Structural Drawings.
3. Welded Construction: Comply with AWS Code for procedures, appearance, and quality of welds, and methods used in correcting welded work.
4. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.

C. Holes for Other Work:
1. Provide holes required as detailed on drawings for securing other work to structural steel framing, and for passage of other work through steel framing members, and show on the Shop Drawings.
2. Provide threaded nuts welded to framing, and other specialty items as shown, to receive other work.
3. Cut, drill, or punch holes perpendicular to metal surfaces.
4. Do not flame cut holes or enlarge holes by burning.
5. Drill holes in bearing plates.

2.5 SHOP PAINTING

A. General:
1. Shop paint structural steel work, except for the following:
a. Those members or portions of members to be embedded in concrete or mortar.
2. Paint embedded steel which is partially exposed on the exposed portions, and the initial 2" of embedded areas only.
3. Do not paint surfaces which are to be welded or high-strength bolted with friction type connections.
4. Apply two coats of paint to surfaces which are inaccessible after assembly or erection. Change color of the second coat to distinguish it from the first.

B. Surface Preparation:
1. After inspection and before shipping, clean steel work to be painted.
2. Remove loose rust, loose mill scale, and spatter, slag, and flux deposits.
3. For interior steel, clean in accordance with SSPC-SP3, Power Tool Cleaning.
4. For exterior steel, clean in accordance with SSPC-SP6, Commercial Blast Cleaning.

C. Painting:
1. Immediately after surface preparation, apply structural steel primer paint in accordance with the manufacturer's recommendations and at a rate to provide a uniform dry film thickness.
2. Use painting methods which will result in full coverage of joints, corners, edges, and exposed surfaces.

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 ERECTION

A. Comply with AISC specifications and "Code of Standard Practice," except as may be modified herein.

B. Anchor Bolts:
1. Provide anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.
2. Provide templates and other devices necessary for presetting bolts and anchors to accurate locations.

C. Bases and Bearing Plates: Shop weld to columns and members attached to concrete, unless otherwise shown on drawings.

D. Splicing:
1. Splice members only where indicated unless, with the Architect's approval, splices not indicated would result in lower costs due to reduced shipping expense.
2. For splices not indicated, submit structural calculations prepared and signed by a structural engineer licensed to practice in the state of California.
3. Splices of members not indicated on the drawings will required DSA approval.

E. Gas Cutting:
1. Do not use gas cutting torches for correcting fabricating errors in the structural framing.
2. Cutting will be permitted only in secondary members as acceptable to the Architect.
3. When gas cutting is permitted, finish the gas cut section to a sheared appearance acceptable to the Architect.

F. Surveys:
1. Establish permanent benchmarks necessary for accurate erection of structural steel.
2. Check elevations of concrete surfaces, and locations of anchor bolts and similar items, before erection proceeds.

G. Temporary Shoring and Bracing:
1. Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads.
2. Provide temporary guy lines to achieve proper alignments of the structure as erection proceeds.
3. Remove temporary connections and members when permanent members are in place and the final connections have been made.

H. Setting Bases and Bearing Plates:
1. Clean concrete bearing surfaces free from bond-reducing materials, and then roughen to improve bond to the surface.
2. Clean the bottom surface of base and bearing plates.
3. Set loose and attached base plates and bearing plates for structural members in wedges or other adjusting devices.

4. Tighten anchor bolts after the supported members have been positioned and plumbed.
5. Do not remove wedges or shims but, if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.
6. Pack grout solidly between bearing surfaces and bases or plates to assure that no voids remain.
7. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturers' recommendations as approved by the Architect.

I. Field Assembly:
1. Set structural frames accurately to the lines and elevations indicated.
2. Align and adjust members forming part of a complete frame or structure before fastening permanently.
3. Clean the bearing surface, and other surfaces which will be in permanent contact, before assembly.
4. Adjust as required to compensate for discrepancies in elevation and alignment.
5. Level and plumb individual members of the structure within specified AISC tolerances.
6. Establish required leveling and plumbing measurements on the mean operating temperature of the structure, making allowances for the difference between temperature at time of erection and the mean temperature at which the structure will be when completed and in service.
7. Comply with AISC specifications for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to welds.

J. Automatic End Welded Studs:
1. The studs shall be automatic end welded in accordance with the manufacturer’s recommendations in such a manner as to provide complete fusion between the end of the stud and the plate.
2. There should be no porosity or evidence of lack of fusion between the welded end of the stud and the plate.
3. The stud shall decrease in length during welding approximately 1/8" for 5/8" and under, and 3/16" for over 5/8" diameter.
4. Welding shall be done only by qualified welders approved by the welding inspector.

3.3 TESTING AND INSPECTING

A. Testing: Refer to Section 01 4520 for testing and inspection requirements.
1. The Owner's selected testing laboratory will pick up specimens and make required tests.
2. Cost of procuring test specimens at locations more than 50 miles from the job site will be paid by the Owner and back charged to the Contractor.
3. Costs of tests of identified stock will be paid by the Owner; except that if a test fails to comply with the specified requirements, the cost of testing will be paid by the Owner and back charged to the Contractor.
4. Costs of tests of unidentified stock will be paid by the Owner and back charged to the Contractor.

B. Test Specimens:
1. Test specimens shall be furnished by the steel fabricator, and shall be taken under the direction of the Owner's testing laboratory.
2. Each specimen shall be machined by the Owner's selected testing laboratory to dimensions required by ASTM A370.
3. Cost of procuring, making, and machining test specimens shall be considered test costs as defined above.

C. Material Identification and Testing:
1. Identification of structural steel members shall comply with AISC 360.
2. Steel not readily identifiable as to grade from marking and test records shall be tested to determine conformity to the specified standards.
3. Additional tests may be required when deemed necessary by the Architect.

D. Shop and Field Inspection: A complete four sided inspection of steel will be made when required by the

Architect. The Contractor shall provide labor, equipment, and facilities needed to move and handle the materials to be inspected.

1. Cost of inspecting will be paid by the Owner subject to the same provisions made above for tests.
2. If, after fabrication and inspection, the work of this Section is found to be defective and to require reinspection, cost of such reinspection will be paid by the Owner and back charged to the Contractor.
3. Access: The Contractor shall provide access for the testing agencies and inspectors to places where structural steel work is being fabricated or produced, so that required testing and inspecting may be accomplished.

E. Welding Inspection:
   1. Unless otherwise specified, perform all shop and field welding under observation of a qualified inspector from a testing laboratory approved by the Architect and the DSA; CBC Section 1705A.2.5 and Table 1705A.2.1.
   2. Inspect every layer of weld for quality, penetration, and conformity with design requirements.
   3. Require the welding inspector to submit a signed report to the Architect, Structural Engineer, and DSA verifying that:
      a. The welding is adequate and was performed in conformity with specified requirements; and
      b. Adequate methods have been used to determine the quality of the welding.
   4. The welding inspector may use gamma ray, magnaflux, trepanning, or any other aid to visual inspection considered necessary to assure adequacy of welding, or may use ultrasonic testing performed in accordance with pertinent requirements of governmental agencies having jurisdiction.
   5. Cost of welding inspection will be paid by the Owner in accordance with Section 01 4520.

F. Erection Inspecting:
   1. The Owner's testing and inspecting agency will inspect the installation of all high strength bolted connections, will visually inspect field welded connections, will perform such additional tests and inspections of field work as are required by the Architect, and will prepare test reports for the Architect, Structural Engineer, and DSA; CBC Section 1705A.
   2. The testing agency will conduct and interpret the tests, and will state in each report whether the inspected work complies with the requirements, specifically stating all deviations therefrom.

G. Corrections:
   1. Correct deficiencies in structural steel work which inspections and test reports indicate to be not in compliance with the specified requirements.
   2. Perform additional tests required to reconfirm noncompliance of the original work and to show compliance of corrected work, all at no additional cost to the Owner.

H. Automatic End Welded Studs: Inspection, in accordance with CBC Section 1705A.2.1, of all shop and field welding operations for automatic end welded studs shall be made by a qualified welding inspector approved by the DSA. The type and capacity of the welding equipment shall be in accordance with the manufacturers recommendations and shall be checked and approved by the welding inspector.

3.4 FIELD PAINTING

A. General:
   1. Prepare surfaces in a manner appropriate to the condition in strict accordance with the manufacturer's written recommendations.
   2. Clean spots and surfaces where primer coats have been removed, damaged, or burned off, and clean field bolts and other field connections not concealed in the finished Work.
   3. Remove dirt, oil, and grease.
   4. Apply a spot coat of the approved primer.
   5. Do not apply paint to wet, damp, oily, or improperly prepared surfaces.

B. Using spray or brush, as recommended by the manufacturer of the approved paint material, fill all joints and corners and cover the surfaces with a smooth unbroken film of at least 1.5 dry mils thickness.

END OF SECTION 05 1200

SECTION 05 5000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide miscellaneous metal work shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 09 9100: Field painting of steel members.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data:
a. Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
b. Submit manufacturers recommended installation procedures.
2. Shop Drawings: Submit shop drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.

1.3 QUALITY ASSURANCE

A. Perform shop and/or field welding required in connection with the work of this Section in strict accordance with pertinent recommendations of the American Welding Society.

B. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedures" and CBC Section 2204A.1.

C. Codes and Standards: Comply with provisions of the following: California Building Code, 2022 Edition.

1.4 MOCK-UPS

A. Ornamental Railing: After shop drawing review, and prior to fabrication of ornamental railing, fabricate full size mock-up including at a minimum, 4 circle insets, top pipe rail, intermediate horizontal rails, 4 pickets, and 1 vertical support post, and typical connection between rail panels. **Mock-up shall demonstrate the finishes and workmanship required by the Contract Documents.**

B. Acceptance: If, upon review by the Architect, the mock-up is found to be satisfactory, the mock-up shall be used as the basis, along with the other provisions of the Contract Documents, for determining the acceptability of ornamental railings provided as part of the work of this Section. The accepted mock-up shall remain on the project site until completion of the Work.

C. Rejection: If, upon review by the Architect, the mock-up is found to be unsatisfactory, remove the mock-up, revise and rework as required, and provide a new mock-up for further review.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Comply with following standards, as pertinent, unless otherwise noted in the documents.
1. Steel Sections: ASTM A36.
2. Steel Tubing: ASTM A500, Grade C cold-formed structural tubing.
3. Steel Pipe: ASTM A53, Type S, Grade B, standard weight or extra-strong as noted in the plans.
4. Bolts, Nuts, and Washers: ASTM A325, Type 1, galvanized to ASTM A153 where connecting galvanized components.
5. Welding Materials: AWS D1.1; type required for materials being welded.
6. Aluminum Sheet: ASTM B209, 5005-H32 minimum; alloy and temper recommended by aluminum producer and finisher for use and finish indicated.
7. Galvanized Steel Sheet: ASTM A653; G90 coating.
8. Steel Sheet: ASTM A1008; uncoated, cold rolled commercial steel, exposed or ASTM A879 electrolytic zinc coating over ASTM A 1008, steel sheet substrate.
9. Stainless Steel Sheet: ASTM A666, Type 304; stretcher-leveled.

2.2 FASTENERS

A. General:
1. For exterior use and where built into exterior walls, provide zinc-coated fasteners.
2. Provide fasteners of type, grade, and class required for the particular use.

B. Bolts, Nuts, and Washers: ASTM A325, Type 1, galvanized to ASTM A153 where connecting galvanized components.

2.3 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.

2.4 FINISHES

A. Primer: 10-99 by Tnemec or No. 5269 by Rustoleum.

B. Provide zinc coating for those items indicated or specified to galvanized, as follows:
1. ASTM A153 for galvanizing iron and steel hardware.
2. ASTM A123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strips 1/8" thick and heavier.
3. ASTM A386 for galvanizing assembled steel products.
4. ASTM A535 for galvanizing sheet steel.

C. For repair of galvanizing, use a high zinc-dust content paint complying with MIL-P-21035.

D. Slip Resistant Finish:
1. Basis of Design: SlipNOT by W.S. Molnar Company, 800-754-7668, www.slipnot.com.
2. Anti-slip, non-gritted, steel surface bonded to steel substrate by metal plasma stream deposition process.

3. Surface Texture: [Grade 1, Fine] [Grade 2, Medium] [Grade 3, Coarse].
4. Surface Hardness: Minimum of 55, Rockwell C Scale, ASTM E140 and E384.
5. Bond Strength, Surface to Substrate: Minimum of 4,000 psi, ASTM C633.
6. Coefficient of Friction, Anti-Slip Surface: Minimum of 0.6.
7. UL Listed: UL 410 slip resistant.

2.5 FABRICATION

A. Except as otherwise shown on the Drawings or the approved Shop Drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.

B. In fabricating items which will be exposed to view, limit materials to those which are free from surface blemishes, pitting, rolled trade names, and roughness.

C. Fabricate with accurate angles and surfaces which are true to the required lines and levels, forming exposed connections with hairline joints, and using concealed fasteners wherever possible.

D. Provide for anchorage of type indicated, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use. Cut, reinforce, drill, and tap miscellaneous metal work as required to receive finish hardware and similar items.

E. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

F. Curved work shall be evenly sprung.

2.6 FABRICATED ITEMS

A. Rough Hardware: Provide bent or otherwise custom fabricated bolts, plates, anchors, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting work, and for anchoring or securing work to concrete or other structures.
   1. Provide galvanized rough hardware at exterior conditions.

B. Miscellaneous Framing and Supports: Provide miscellaneous framing and supports not a part of the structural steel framework, as required to complete the work.
   1. Fabricate miscellaneous units to shapes, sizes, and profiles indicated, or if not indicated, of required dimensions to receive adjacent work. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware and similar items.
   2. Provide galvanized framing and supports at exterior conditions.

C. Steel Handrails, Guards, and Railings: Provide round pipe or square tubing as indicated on the Drawings.
   1. Round Pipe: 1-1/2" nominal diameter standard weight galvanized steel pipe, 0.145" wall thickness.
   2. Square Tubing: 1-1/2" galvanized steel square structural tubing, 0.1875" wall thickness.
   3. Wall Brackets: No. 377/378 by Julius Blum, or No. 1703-2 by R&B Wagner, with bracket filler for either gypsum board or plaster.
   4. Fabrication:
      a. Provide flush fittings with joints welded and ground smooth and flush. Weld vertical supports to horizontal members in same manner as fittings.
      b. Remove burrs from all exposed cut edges.
      c. Miter or radius all joints as required. Form elbow bends and wall returns to uniform radius, free from buckles and twists, with smooth finish surfaces, or use prefabricated bends.
      d. Provide wall returns at ends of wall mounted handrails to with 1/8" of wall.

e. Close exposed ends by welding 3/16" minimum thickness steel plate in place or with prefabricated fittings.
f. Provide galvanized steel sleeves for concrete embedment where indicated.
g. Secure ends of members butted to vertical surfaces with galvanized steel flanges.
h. Secure handrails to walls with brackets spaced at 5'-0" on center maximum.
i. Provide vertical posts at the spacing indicated, but not more than 5'-0" on center.
j. Welding: Accurately miter and cope intersections of posts and rails and weld all around. Thoroughly fuse without undercutting or overlap. Remove spatter, grind exposed welds and contour surfaces to match those adjacent.
k. Provide pressure relief holes at closed ends.

D. Steel Ladders:
1. Fabricate stringers and brackets from steel flat bar.
2. Provide 3/4" x 3/4" solid steel ladder rungs with aluminum oxide grit bonded to steel base; MEBAC by McNichols or approved equal.
3. Provide welded assembly with all welds ground smooth.

E. Computer Counter Cable Tray: Fabricate tray to profile indicated from 18 gage sheet steel with factory-applied baked enamel finish (2.0 mils minimum dry film thickness, color as selected by the Architect). Provide cut-outs for electrical outlets. Fabricate to maximum length possible keeping joints to a minimum.

F. Steel Grating: Fabricate frame from steel angles with anchors. Fabricate grating from 1-1/4" x 1/4" minimum steel bearing bars spaced at 3/4" on center with welded 3/4" x 1/4" steel cross bars spaced at 4" on center. Hot-dip galvanize frame, grating, and fasteners with a coating weight of not less than 1.5 ounces per square foot of coated surface.
1. Provide removable grating sections with banding bars attached by welding to entire perimeter of each section. Provide not less than 4 saddle clips for each section, with each clip designed and fabricated to fit over 2 bearing bars. Provide threaded bolts with nuts and washers for each clip required.

G. Barrier Gates: Fabricate from galvanized standard and extra-strong pipe. Provide welded assembly with all welds ground smooth. Provide sleeve assemblies, for proper operation and locking, fabricated from galvanized materials as indicated. Embed gate post in concrete, fill post with concrete, and shape top as indicated providing a smooth, finished appearance.

H. Removable Bollards:
1. Removable locking bollard, ground sleeve, and sleeve top and lid, powder-coated factory finish, RPL4 by TrafficGuard Direct, Inc., www.trafficguard.net or approved equal.
2. Bollard completely removes from the ground sleeve and provides flush surface.
3. Install bollard and ground sleeve in conformance with the manufacturer's written installation instructions. Provide gravel base for drainage of bollard.

I. Ornamental Railings: Fabricate from galvanized steel pipes, tubes, and shapes as indicated to the design, dimensions, and details shown.
1. Fabricate and install railing to withstand a concentrated load of at least 200 pounds force applied in any direction at any point on the rail.
2. Fabricate railing for interconnection of members by welding. Preassemble railing units in shop to maximum extent practical and consistent with shipping and handling limitations.
3. Perform welding in accordance with the applicable AWS specifications, using methods appropriate for the metal and finish indicated. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.
4. Close exposed ends of rail members by use of prefabricated end fittings, matching exposed member material and finish.
5. Provide wall brackets, flanges, and miscellaneous fittings and anchors for interconnection of railing

members to other work. Coordinate anchorage devices with supporting structure.
6. Fit exposed connections accurately to form tight, hairline joints.
7. Adjust railings prior to anchoring to insure matching alignment at abutting joints.
8. Tolerances:
   a. Machine field and shop joints to fit within 1/32"+/-.
   b. Install freestanding items to +/- 1/8" of indicated position, plumb and level.
   c. Size each element of an assembly within 1/8" of correct dimension.

J. Steel Lintels: Steel angles of sizes required for supporting masonry above openings. Provide for minimum bearing of 8" each end. Galvanize exterior lintels.

K. Masonry Shelf Angles: Steel angles of sizes detailed. Omit shop paint from interior units. Galvanize exterior units.

2.7 SHOP PAINTING

A. Surface Preparation: Prepare ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Exteriors (SSPC Zone 1B): SSPC-SP6, Commercial Blast Cleaning.
   2. Interiors (SSPC Zone 1A): SSPC-SP3, Power Tool Cleaning.

B. Cleaning: Clean ferrous and galvanized metal surfaces with proper solvents to remove all grease and other foreign matter which will hinder and/or prevent proper finishing and installation.

C. Application: Apply 1 coat of shop primer to the dry film thickness recommended by the manufacturer to surfaces of metal fabrications except those which are indicated to be embedded in concrete or masonry and in compliance with requirements of SSPC-PA1, Paint Application Specification No. 1, for shop painting.

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 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

A. General:
   1. Set work accurately into position, plumb, level, true, and free from rack.
   2. Anchor firmly into position.
   3. Where field welding is required, comply with AWS recommended procedures of manual-shielded metal-arc welding for appearance and quality of weld and for methods to be used in correcting welding work.
   4. Grind exposed welds smooth, and touch up shop prime coats.
   5. Do not cut, weld, or abrade surfaces which have been hot-dip galvanized after fabrication and which are intended for bolted or screwed field connections.

B. Primer Repair: Immediately after erection, clean the field welds, bolted connections, and abraded areas of shop priming. Paint the exposed areas with same material used for shop priming.

C. Galvanizing Repair: Repair all damage to galvanizing as a result of fabrication, handling, and installation, with 2 coats of cold galvanizing paint in accordance with the manufacturer's written instructions.

D. Pipe Railings and Handrails: Unless otherwise indicated or approved by the Architect:
   1. Secure to wall with approved fasteners into solid blocking.

END OF SECTION 05 5000

SECTION 05 5840 - STAINLESS STEEL FABRICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide the materials and fabrication for stainless steel items in the work, excluding the work in Section 11 4000, where shown on the Drawings, or as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 06 4000: Rough openings for equipment and accessories in cabinets.
3. Section 11 4000: Food service equipment.
4. Section 22 0000: Final plumbing connections of equipment and accessories.
5. Section 26 7000: Final electrical connections of equipment and accessories.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings showing details of layout, installation, anchorage, and interface with the work of other trades.
4. **Utility Service Connections:** Deviations from utility requirements indicated on the Drawings shall be clearly noted and coordinated with the trades involved.

1.3 QUALITY ASSURANCE

A. Except as otherwise specifically approved in writing by the Architect, manufacture and install all materials of this Section in strict compliance with at least the minimum requirements of:
1. American Society for Testing and Materials (ASTM);
2. American Society of Mechanical Engineers (ASME);
3. National Sanitation Foundation (NSF);
4. All governmental agencies having jurisdiction.

1.4 SPECIAL WARRANTY

A. In addition to the warranty requirements of the Contract Documents, submit 2 original copies of the manufacturer's **2-year warranty** on all materials and workmanship.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide only new materials, of the highest grade available, free from defects and imperfections, of recent manufacture, and with the following attributes except as may be otherwise approved by the Architect.

B. Bolts, Screws, and Rivets:

1. Wherever possible, provide equipment and connections with exposed surfaces free from bolt heads, screw heads, and rivets.
2. Wherever bolts are used to fasten trim to paneling of counters, cabinets, and similar equipment, and to fasten tops of counters to their framing, use corrosion-resisting metal of the same alloy composition as the metal to which they are fastened.
3. When iron bolts or screws are authorized to be used, provide a suitable metallic coating for protection against corrosion.
4. Wherever threads of bolts or screws might come into contact with a wiping cloth, cap the threads with a suitable lock washer and chromium plated or bronze acorn nut.

2.2 MATERIALS

A. Stainless steel:
   1. Provide US Standard Gage 18-8, type 302, maximum carbon 0.012%, with No. 4 finish;
   2. Where spans exceed 30" in the least direction, provide 16 gage material;
   3. Where spans exceed 60" in the least direction, provide 14 gage material;
   4. Finish welds to match the No. 4 finish.

B. Welding and Soldering:
   1. Shop weld or solder all seams and joints as the nature of the material used may require;
   2. Weld all materials 18 gage and heavier.

C. Metal Tops:
   1. Provide metal tops of one piece welded construction, reinforced on the underside with galvanized steel channels welded in place so tops can support heavy weights without deflection;
   2. Provide cross braces at not closer than 30" on center.

D. Except as otherwise detailed or specified, make rolled edges approximately 1-3/8" in diameter, with corners bullnosed, ground, and polished.

E. Corners:
   1. Provide radius bends in all horizontal and vertical corners, coved at intersections, unless otherwise detailed or specified;
   2. Make rounded and coved corners, and radius bends, 1/2" radius or more.

F. Legs and Cross Rails:
   1. Fabricate from 16 gage 1-5/8" diameter stainless steel tubing unless otherwise detailed or specified;
   2. At cross rails, make all welds continuous and grind smooth; tack welds are not acceptable;
   3. Fit the bottoms of legs at the floor with a stainless steel bullet-type foot having not less than 2" adjustment;
   4. Fasten legs to equipment: To metal tops with the same type enclosed gussets as specified above, but welded to stainless steel channels 14 gage or heavier.
   5. Stainless steel adjustable feet:
      a. Provide 302 or 304 stainless steel exterior on not less than 1-1/2" diameter threaded cold rolled steel rod;
      b. Provide not less than 2" adjustment;
      c. Weld the assembly, and provide seismic anchorage approved by the Architect and Division of the State Architect.

G. Shelves:
   1. At fixtures with enclosed bases, turn up shelves at back and sides, and feather slightly to assure a tight fit to enclosure panels;
   2. At fixtures with open bases, notch shelves a full 90̊ and weld tightly to leg with tight joints at all

intersections of shelf and leg.

H. Closures: Fill the ends of all work by forming the metal or welded sections if necessary, to finish the entire rear of the fixture or similar item flush to walls and adjoining fixtures.

2.3 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 areas and conditions under which the 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, GENERAL

A. Except as modified by requirements of governmental agencies having jurisdiction, install in accordance with recommendations of the manufacturer as approved by the Architect.

B. Coordinate with adjacent trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 SEISMIC RESTRAINT

A. Where anchorage details are not shown on the drawings or in the guidelines, the field installation shall be subject to the approval of the Architect and the DSA Field Engineer.

3.4 CLEANING UP

A. In addition to other stipulated requirements for cleaning, completely remove finger prints and traces of soil from the surfaces of all work of this Section, using only those cleaning materials recommended for the purpose by the manufacturer of the material being cleaned.

END OF SECTION 05 5840

SECTION 06 1100 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Provide lumber, construction panels, structural composite wood, nails, bolts, screws, framing anchors and other rough hardware, and other items needed, and perform rough carpentry for the construction shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 06 1730: Wood I-joists.
3. Section 06 1800: Structural glued-laminated timber.
4. Section 06 4000: Architectural woodwork.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements for the following:
a. Framing anchors.
b. Preservative treatment.
2. Installation Procedures: Submit manufacturers recommended installation procedures.

B. Machine Nail Samples: Contractor shall allow the Inspector to take random samples from actual machine nail containers proposed for use on the project. Samples shall be reviewed and accepted prior to any machine nailing. Nails sampled shall meet the requirements for machine nailing indicated on the Drawings.

1.3 QUALITY ASSURANCE

A. Codes and Standards:
1. All material and workmanship shall comply with CBC Chapter 23 and ANSI/AWC NDS 2018.
2. **Lumber standards:** DOC PS-20-05 American Softwood Lumber Standard, with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review. Factory mark all lumber indicating the specie and grade of each piece.
3. **Inspection Agencies:** All lumber shall be graded in accordance with Standard Grading Rules for West Coast Lumber, No. 17 by West Coast Lumber Inspection Bureau (WCLIB), or Western Lumber Grade Rules, latest edition by Western Wood Products Association (WWPA).
4. **Plywood Panel Standards:** DOC PS–1-09 Construction and Industrial. For products not manufactured under PS-1 provisions, with American Plywood Association (APA) Performance Standard and Policies for Structural-Use Panels, Form No. E445. Plywood used for structural purposes shall be marked "APA W/EXT GLUE" and shall be span-rated sheathing. Factory-mark each plywood panel with APA trademark evidencing compliance with grade requirements.
5. **Preservative Treatment:** Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Rejection:
1. Below-grade material shall not be used as load-carrying members which have been designed for specified allowable stresses and acceptable safety factors.
2. Any material which falls below grade shall be rejected for load-carrying use.

C. Prefabricated (off-site built) wall framing:
   1. Where fabrication of structural, load-bearing or lateral load-resisting members or assemblies is being conducted “off-site”, special inspections of the fabricated items shall be performed during fabrication. Inspection shall be periodic unless otherwise deemed necessary for continuous inspection.
   2. All costs associated with “off-site” wall framing will be paid directly by the Owner to the Project Inspector or Lab of Record, but these costs shall be invoiced to the Contractor by the Owner and withheld from payments and/or retention.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 6600.

B. Protection:
   1. Deliver the materials to the job site and store, in a safe area, out of the way of traffic, and shored up off the ground surface.
   2. Identify framing lumber as to grades, and store each grade separately from other grades.
   3. Protect metals with adequate waterproof outer wrapping.
   4. Use extreme care in off-loading of lumber to prevent damage, splitting, and breaking of materials.

PART 2 - PRODUCTS

2.1 LUMBER

A. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by DOC PS-20-05, for moisture content specified for each use.
   1. Provide dressed lumber, S4S, unless otherwise indicated.
   2. Provide seasoned lumber with 19% maximum moisture content at time of dressing and shipment, and at time of use, unless otherwise indicated.

B. Slope of grain of lumber used in tension members shall not exceed 1:8 slope.

C. Framing lumber shall be No. 1 Douglas Fir, unless otherwise indicated on the drawings.

D. Where wood member are in contact with masonry or concrete, use No. 1 Douglas Fir pressure treated with an approved factory preservative treatment as specified in this Section.

E. **ALL 3X AND LARGER MATERIAL SHALL BE "FREE OF HEART CENTER".**

F. Fascia: Provide Hem-Fir material at all finished fascia boards and at fascia boards covered with metal fascia and trim.

2.2 CONSTRUCTION PANELS

A. Plywood: Exterior Grade with exterior glue, graded to conform to DOC PS-1-09.

B. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels with grade designation, APA A-C PLUGGED and SANDED INT with exterior glue, 3/4" thick.

C. Roof Sheathing: APA Rated Sheathing, C-D, Exposure 1; thickness and span index as indicated.

D. Wall Sheathing: APA Rated Sheathing, C-D, Struct I, Exposure 1; thickness and span index as indicated.

E. Subfloor: APA Rated Sheathing, C-D, Exposure 1, T & G; thickness and span index as indicated.

F. Underlayment: Particleboard, ANSI A208.1, Grade PBU, 3/8" minimum thickness.

2.3 ACCESSORIES AND OTHER MATERIALS

A. Building Paper: Kraft paper; ASTM D227.

B. Sheet Metal Framing Anchors: Shall be as noted on the drawings.

C. Machine Bolts: ASTM A307.

D. Lag Bolts: ASME B18.2.1.

E. Nails:
1. Use **common nails** except as otherwise noted.
2. Comply with ASTM F1667. Minimum dimensions shall be as follows:

Pennywt.	Shank Dia.	Head Dia.	Length
8d	0.131" ± .004"	0.281" ± 10%	2.5" ± 1/16"
10d	0.148" ± .004"	0.312" ± 10%	3.0" ± 3/32"
16d	0.162" ± .004"	0.344" ± 10%	3.5" ± 3/32"

3. All nails for pressure treated or fire-retardant lumber shall be hot-dipped zinc-coated galvanized. Nails with other types of galvanizing may be used if pre-approved by the enforcement agency.

F. Fasteners and Anchors: Size, type, material as indicated and as recommended by applicable standards; unfinished, except as specified below.
1. In Preservative Treated Wood:
   a. Use Categories UC2 and UC3B: Hot-dip zinc coating, types and weights in accordance with the treated wood or anchor manufacturer; ASTM A153 or F2329.
   b. Use Category UC4A: Type 316L stainless steel.
2. In Exposed Exterior Conditions: Type 316L stainless steel.
3. In Concrete or Masonry: Mechanically deposited zinc coating; ASTM B695, Class 55 minimum.

G. Connectors and Hangers: Fabricate from steel with minimum ASTM A653 G90 zinc coating, thickness to suit framing conditions.
1. At Preservative Treated Wood:
   a. Use Categories UC2 and UC3B: Hot-dip zinc coating; ASTM A653, G185 minimum.
   b. Use Category UC4A: Type 316L stainless steel.
2. At Exposed Exterior Conditions: Type 316L stainless steel.

H. Construction Adhesives: Comply with VOC requirements of California Green Building Standards Code, Section 5.504.4.1.

2.4 STRUCTURAL COMPOSITE LUMBER

A. Laminated Veneer Lumber (LVL): Structural composite lumber manufactured from veneers of a single wood species, or specie combinations, bonded through a continuous-feed press, with grain oriented parallel to the length of the member with approved adhesives, free of finger joints, scarfs, or mechanical connections in full length members.

1. Moisture Content: Between 2 and 8 percent.
2. Adhesive: Waterproof type; ASTM D-2559.

B. Provide sizes indicated on the Drawings, with the following minimum properties:
1. F_b = 2900 psi.
2. F_v = 285 psi.
3. E = 2.0 x 10^6 psi.

C. Fabrication: Manufacture laminated veneer lumber in a plant accepted by the authority having jurisdiction and under the supervision of a third party inspection agency. Identify each member with identification stamp; Section 7.10 of ICC ESR-2993.

2.5 FACTORY PRESERVATIVE TREATMENT

A. Lumber Above Grade: AWPA U1-14, Use Category UC2, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
2. Treat lumber in contact with masonry or concrete.
3. Treat lumber in other locations as indicated.

B. Lumber Exposed to Weather: AWPA U1-14, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
2. Treat lumber exposed to weather.

C. Lumber in Contact with Soil: AWPA U1-14, Use Category UC4A, Commodity Specification A using waterborne preservative to 0.4 lb/cu ft retention.
1. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
2. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

D. Plywood Above Grade: AWPA U1-14, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention.
1. Kiln dry plywood after treatment to maximum moisture content of 15 percent.
2. Treat plywood in contact with masonry or concrete.
3. Treat plywood in other locations as indicated.

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 COMPLIANCE

A. Do not permit materials not complying with the provisions of this Section to be brought onto or to be stored at the job site.

B. Promptly remove non-complying materials from the job site and replace with materials meeting the requirements of this Section.

3.3 WORKMANSHIP

A. Produce joints which are tight, true, and well nailed, with members assembled in accordance with the Drawings and with pertinent codes and regulations.

B. Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.

C. Lumber Selection:
1. Select individual pieces so that knots and obvious defects will not interfere with placing bolts or proper nailing, and will allow making of proper connections.
2. Cut out and discard defects which render a piece unable to serve its intended function.
3. Lumber may be rejected by the Architect, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.

D. **Do not shim any framing component unless specifically indicated on the drawings.**

3.4 GENERAL FRAMING

A. General:
1. In addition to framing operations normal to the fabrication and erection indicated on the Drawings, install wood blocking and backing required for the work of other trades.
2. Set horizontal and sloped members with crown up.
3. Do not notch, cut, or bore members for pipes, ducts, or conduits, or for other reasons except as shown on the Drawings or as specifically approved by the Architect.

B. Bearings:
1. Make bearings full unless otherwise indicated on the Drawings.
2. Finish bearing surfaces on which structural members are to rest so as to give sure and even support.
3. Where framing members slope, cut or notch the ends as required to give uniform bearing surface.

C. Fire Blocks and Draft Stops: CBC Section 718.
1. **General:** In combustible construction, firestopping and draft stopping shall be installed to cut off all concealed draft openings (both vertical and horizontal) and shall form an effective barrier between floors, between a top story and a roof or attic space, and shall subdivide attic spaces, concealed roof spaces and floor-ceiling assemblies. The integrity of all fire and draft stops shall be maintained.
2. **Fire Stops:** Provide firestopping in the following locations:
   a. In concealed spaces of stud walls and partitions, including furred spaces, at the ceiling and floor levels and at 10'-0" intervals along the length of the wall.
   b. In fire sprinklered buildings having furred spaces without sprinklers, provide minimum 1/2" thick plywood fire stop so spaced (horizontally or vertically) to contain no more than 51 cubic feet of area. Coordinate with fire sprinkler installer.
   c. At all interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings and cove ceilings;
   d. In concealed spaces between stair stringers at the top and bottom of the run and between studs along and in line with the run of stairs if the walls under the stairs are unfinished;
   e. In openings around vents, pipes, ducts, chimneys, fireplaces and similar openings which afford a passage for fire at ceiling and floor levels, with noncombustible materials.
3. **Draft Stops:** Provide draft stopping at locations indicated on the drawings.

D. Furring, Stripping, Grounds, and Backing:

1. All wood furring, stripping, blocking, bucks and grounds shall be furnished and installed by the Contractor where required for support or backing for other materials whether shown or not on the drawings and/or these specifications. All pipes and ducts shall be furred in wherever shown.
2. Provide horizontal and vertical backing and blocking for nailing all joints at walls, parapets, ceilings, soffits, etc. finish materials shall be provided whenever needed throughout the building. Horizontal and vertical backing shall also occur at counter heights, wainscot heights and for securing all fixtures, cabinet work, shelving and all other items that require support from the wall.
3. Furnish and set all wood grounds for plastering, sheet metal and other trades. Grounds shall be of proper size and spacing for the installation of work as noted under the various headings.
4. All blocks, grounds, etc., which are embedded in concrete shall be dipped in creosote after being cut to size and after nails are driven which are to hold them in the concrete.

E. Plywood Installation:
   1. Placement:
      a. Place plywood with face grain perpendicular to supports and continuously over at least two supports, except where otherwise shown on the Drawings.
      b. Center joints accurately over supports, unless otherwise shown on the Drawings.
      c. Stagger panel end joints.
   2. Protect plywood from moisture by use of waterproof coverings until the plywood in turn has been covered with the next succeeding component or finish.
   3. Installation of plywood shall comply with the requirements of CBC and the APA. If in conflict conform to CBC.
   4. Floors: In addition to nailing, first provide continuous panel adhesive over all joists and blocking on plywood floors typical. Adhesive shall be manufactured for the above purpose.
   5. Underlayment: Stagger panel end joints and offset all underlayment joints by at least 2" from joints in subfloor.

F. Nailing:
   1. Use only common wire nails or spikes of the dimension shown on CBC Table 2304.10.1 - Fastening Schedule, except where otherwise specifically noted on the Drawings.
   2. For conditions not covered in the Nailing Schedule provide penetration into the piece receiving the point of not less than 1/2 the length of the nail or spike, provided, however, that 16d nails may be used to connect two pieces of 2" (nominal) thickness.
   3. Nail without splitting wood.
   4. Pre-bore as required.
   5. Remove split members and replace with members complying with the specified requirements.

G. Bolting:
   1. Drill holes 1/32" larger in diameter than the bolts being used.
   2. Drill straight and true from one side only.
   3. Do not bear bolt heads on wood, but use washers under head and nut where both bear on wood, and use washers under all nuts.

H. Lag Screws: Prebore holes to 40% to 70% of shank diameter at threaded portion, enlarging holes to shank diameter for length of shank.

I. Wood Screws:
   1. Preboring is not required but shall not exceed 7/8 x shank diameter and 7/8 x diameter of the screw at the root of the thread.
   2. Do not hammer screws into holes, soap may be used to facilitate insertion.

J. Sills and Plates:
   1. Install pressure preservative-treated lumber for plates and sills in conformance with CBC Section 2304.10.5.
   2. Bolt to foundations and slabs. Level sills with dry-pack, washers placed, and nuts tightened to level bearing.
   3. Pack space between sill and concrete with dry-pack cement grout.

END OF SECTION 06 1100

SECTION 06 1730 - WOOD I-JOISTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Provide prefabricated wood I-joists where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 06 1100: Rough Carpentry

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Shop Drawings: Submit shop drawings showing fabrication, installation, anchorage, and interface with other components of the structure.

1.3 QUALITY ASSURANCE

A. I-joists shall have a valid evaluation report issued by a qualified independent evaluation agency as prescribed in DSA IR A-5, complying with 2022 CBC, ASTM D5055-05, and ICC-ES AC-14.

B. Identify each of the joist by a stamp indicating the joist series, ICC-ES report number, manufacturer's name, plant number, date of fabrication, and the independent inspection agency’s logo.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 6600.

B. Deliver materials of this Section to the job site in bundles banded together for handling and shipping.

PART 2 - PRODUCTS

2.1 MATERIAL SUBSTITUTIONS

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Substitutions:
1. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500 and are ICC approved.
2. The manufacturer shall be responsible for preparing an Addendum or Construction Change Document for the Architect to submit to DSA for approval of the proposed products in lieu of those indicated on the drawings and in the specifications, including complete shop drawings, details, and calculations (using the original design loads), stamped and signed by a California registered structural engineer.

3. The manufacturer's structural engineer shall travel to DSA offices at no cost to the Owner if required to obtain approval.
4. Costs incurred by the Architect for preparation and processing of a Construction Change Document for substitutions shall be paid by the Contractor.

2.2 WOOD I JOISTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
   1. RedBuilt: Red-I Joist, ESR 2994; basis of design.

B. Top and Bottom Flanges: LVL material, Grade 2.2E covered by a valid ICC-ES evaluation report.

C. Web: Oriented strand board (OSB), Exposure 1, (24/0) APA performance rated sheathing (PRS) or Structural 1 grade complying with PRP-108 and PS2-04.

D. Blocking: All wood I-joist blocking shall be same as related wood I-joists.

2.3 FABRICATION

A. Fabricate wood I-joists in accordance with the DSA approved manufacturing standards and as indicated on the Drawings.

B. General:
   1. Size and detail the work of this Section to fit dimensions and loads indicated on the Drawings.
   2. Design in accordance with allowable values and section properties assigned and approved by the governmental agencies having jurisdiction.

2.4 SOURCE QUALITY CONTROL

A. Provide I-joists from mills that qualify under an approved QA/QC program conforming with:
   1. ASTM D5055, Sections 8, 9, and 10.
   2. ICC-ES AC14, Appendix A, or ICC-ES approved equivalent such as APA QA Policy for Performance Rated I-Joists.
   3. ICC-ES AC14, Appendix B.
   4. Unannounced audits by a third party auditor of a qualified inspection agency shall be performed, per ICC-ES AC14. All quality control reports resulting from such audits must be maintained by the manufacturers and made available to DSA upon request.

PART 3 - EXECUTION

3.1 INSTALLATION AND ERECTION

A. Install wood I-joists in accordance with approved shop drawings and manufacturer's written instructions.

B. Do not impose temporary construction loads that cause stresses beyond design limits.

C. Provide safety bracing to keep wood I-joists straight and plumb, and to ensure adequate lateral support for the individual joist members and the entire system until the sheathing material is applied.

END OF SECTION 06 1730

SECTION 06 1800 - STRUCTURAL GLUED-LAMINATED TIMBER

PART 1 - GENERAL

1.1 SUMMARY

A. Provide structural glued-laminated timber and beams and related items for the construction shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Specification Section 06100: Rough Carpentry.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with CBC Chapter 23, ANSI/AITC A190.1-12, and ASTM D3737.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 6600.

B. Protection:
1. Deliver the materials to the job site and store, in a safe area, out of the way of traffic, and shored up off the ground surface.
2. Protect member with adequate waterproof outer wrapping.
3. Use extreme care in off-loading of lumber to prevent damage, splitting, and breaking of materials.

PART 2 - PRODUCTS

2.1 GLUED-LAMINATED TIMBER MATERIALS

A. Lamination Lumber: West Coast Douglas Fir species, graded in conformance with WCLIB Rules No. 16, Sect. 154, and other requirements of the above standards.

B. Adhesives: Exterior type, ASTM D2559, qualifying for both wet or dry use service conditions.

2.2 MANUFACTURE

A. Comply with AITC Standard A190.1-12, and CBC Section 2303.1.3.
1. Moisture content of wood at time of gluing shall not exceed 12 percent and shall not be less than 7 percent. The range of moisture content of laminations assembled into a single member shall not exceed 5 percent at time of gluing.

B. Combination Grade: According to designated type(s) of member(s) and stress grade(s) required, glulam members are assembled of composite grades of laminations; AITC 117, Table 1A.

C. Bending Members: Unless otherwise specified and/or detailed, tension zone laminations are provided as follows:
1. Simple Beams: Full length at bottom only. (unbalanced section).
2. Cantilever Beams: Full length at top and bottom.
3. Continuous Beams: Full length top and bottom, (balanced section).

D. Compression or Tension Members: Provide combination symbol 24F-E4; 2005 NDS Supplement, Table 5A.

E. End Joints: Qualified pre-glued finger joints bond ends of lumber into continuous laminations. Provide end joint spacing as indicated on the Drawings.

F. Appearance Grades: As specified on drawings, Industrial, per AITC 110-01.

G. Protection:
1. Coatings: End Seal (liquid wax); Surface sealer: Chapman Pen-A-Seal, or equal.
2. Wrapping: Load Wrap (protect in transit); Individual Wrap each beam.

H. Camber: The required camber for fabrication of each member is indicated on the Drawings, and may be either circular or parabolic, at the manufacturer's option.
1. Unless otherwise indicated, all single-span members shall be cambered to a +1600 foot radius. Where manufacturer's standard camber is other than +1600 foot radius, beams shall be manufactured to provide the equivalent of a +1600 foot radius camber.
2. Cantilever and multiple-span members shall not be cambered unless specifically indicated. Cambers, where indicated, shall be a smooth curve on the back-span from support to support and on the cantilever from support to end of cantilever.
3. The Contractor shall be responsible for verification that the fabricated cambers are correct prior to installing beams.

2.3 SOURCE QUALITY CONTROL

A. Inspection:
1. Materials and fabrication shall be approved as required by the Division of the State Architect. The manufacture and fabrication of structural glued-laminated timber shall be in accordance with ANSI/AITC Standard A190.1 and ASTM D3737.
2. All work shall be under the supervision of qualified personnel.
3. All glue-laminated members shall be continuously inspected by an inspector specially approved by the Division of the State Architect; CBC Section 1705A.5.4. An AITC certificate will not meet this requirement.

B. AITC Quality Control: Inspection and Certification per AITC 200-73. Stamp each conforming member with the appropriate AITC Quality Mark and provide an AITC Certificate for each lot or order.

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 COMPLIANCE

A. Do not permit materials not complying with the provisions of this Section to be brought onto or to be stored at the job site.

B. Promptly remove non-complying materials from the job site and replace with materials meeting the requirements of this Section.

END OF SECTION 06 1800

SECTION 06 4000 - ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Provide architectural woodwork where shown on the Drawings, as specified herein, and as needed for a complete and proper installation. Types of woodwork included are:
   1. Plastic covered casework.
   2. Laminated plastic countertops and splashes.
   3. Solid surface countertops and splashes.

B. Related Sections:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
   2. Section 09 9100: Finishing of wood trim and casework.
   3. Section 22 0000: Plumbing brass for sinks specified in this Section.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
   1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
   2. Installation Procedures: Submit 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.
   3. Hardware Schedule: Submit schedule with product data sheets for each type of hardware used.
   4. Shop Drawings: Submit shop drawings in conformance with *NAAWS* Section 1 - Submittals. For further information refer to www.woodworkinstitute.com.
      a. First page shall bear the *Woodwork Institute Certified Compliance Label*.
      b. Shop drawings shall be provided in sufficient details to show fabrication, installation, anchorage, colors, and interface of the work of this Section with the work of adjacent trades.
   5. Samples: Submit four color chip samples of each proposed material in the correct color and finish.
   6. Before delivery to the job-site, the woodwork supplier licensees of the Woodwork Institute shall issue a *Certified Compliance Certificate* with the original submittals indicating the woodwork products furnished for this project and certifying that these products and their installation will fully meet all the requirements of the *NAAWS* grade or grades specified and the Contract Documents.

B. Contract Closeout Submittals: Comply with requirements of Section 01 7700.
   1. Manufacturer's recommended cleaning procedures.

1.3 REFERENCES

A. Minimum standards for work within this section shall be in conformance with the Woodwork Institute.

B. North American Architectural Woodwork Standards (NAAWS).

1.4 QUALITY ASSURANCE

A. In addition to complying with pertinent codes and regulations of governmental agencies having jurisdiction, manufacture and install architectural woodwork in strict accordance with the *North American Architectural Woodwork Standards* for the grades specified. All woodwork shall be provided by a single source WI affiliate

manufacturer that is able to provide a WI *Certified Compliance Certificate*. If provisions for the grade specified are in conflict with, or modified by the drawings and/or specifications, the modifications shall govern.

B. Woodwork Institute Cabinet Design Series (CDS): Refer to Appendix A of the *North American Architectural Woodwork Standards.*
   1. CDS numbers have been used to identify the intended design of individual cabinet units.
   2. Dimensions indicated are for nominal outside dimensions and fabricators are permitted a ½" tolerance in length; no tolerance is permitted for depth and height.
   3. Modifications to the Woodwork Institute Casework Design Series are denoted by the letter "M" following the design number.
   4. Apply finished end panels or integral members on exposed ends of cabinets. Close gaps at wall-to-wall installations by filler panels not to exceed 1-1/2" in width.

C. Coordinate the locations required for solid blocking or backing.

1.5 WOODWORK INSTITUTE CERTIFICATIONS

A. Woodwork Institute Certified Compliance Program (CCP):
   1. Before delivery to the job-site, the woodwork supplier licensees of the Woodwork Institute shall issue a *Certified Compliance Certificate* with the original submittals indicating the woodwork products furnished for this project and certifying that these products and their installation will fully meet all the requirements of the *NAAWS* grade or grades specified and the Contract Documents.
   2. Non-licensees of the Woodwork Institute shall provide WI *Certified Tracking Acknowledgment* with the original submittals, that they have arranged for inspection by a WI Inspector after completion of fabrication and installation. If all conditions are found to be compliant, the inspector will issue a *Certified Compliance Certificate*, indicating the millwork products furnished for this project, and certifying that these products and their installation fully meet all the requirements of the grade or grades specified and the Contract Documents.
   3. Each elevation of woodwork and countertop shall bear a certified compliance label.
   4. In addition to the CCP requirements, the millwork fabricator and/or installer shall allow field inspection by a WI Representative.

B. CCP Costs: The millwork fabricator and/or installer shall pay all costs for certified compliance. Issuance of a Certified Compliance Certificate is a prerequisite for final acceptance.

C. Owner reserves the right to request and pay for additional inspections by a representative of the Woodwork Institute to determine that the work of this Section has been performed in accordance with the specified standards. In the event such inspection determines that the work of this Section does not comply with the specified requirements, immediately remove all non-complying items and replace them with items complying with the specified requirements, all at no additional cost to the Owner, and reimburse the Owner for the cost of the additional inspections.

D. Woodwork and/or installation determined to be non-compliant (and not corrected) will be rejected.

1.6 QUALIFICATIONS:

A. Contractors and their personnel engaged in the work shall be able to demonstrate successful experience with work of comparable extent, complexity and quality to that shown and specified.

B. Fabricator shall be a member/licensee in good standing of the Woodwork Institute.

C. Installer shall be a member/licensee in good standing of the Woodwork Institute.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 6600 and Woodwork Institute *Architectural Woodwork Standards,* latest edition.

B. Deliver all materials only when the area of operation is enclosed and plaster and concrete work is dry, and area is broom clean.

C. Work area shall be well ventilated and protected from direct sunlight, excessive heat, rain or moisture. Temperature shall be maintained between 60̊ and 90̊ F and relative humidity between 45% and 65%. The HVAC system shall be on and functioning.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate all fabrication, delivery and installation work with the general contractor and other applicable trades.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 PLASTIC COVERED CASEWORK

A. Construction: Comply with *Architectural Woodwork Standards Section 10 - Casework*.
   1. Grade: Custom.
   2. Construction Style: Style A Frameless.
   3. Construction Type: Type I - Multiple self-supporting units rigidly joined together or Type II - Single length sections to fit access openings at the Contractor’s option.
   4. Door and Drawer Front Style: Flush Overlay.
      a. Let in 1/8” reveals for all institution hinges specified, unless otherwise noted.
   5. Door and Drawer Edge Type:
      a. Type A for flush doors and drawers.
      b. Type E for glass doors.
   6. Accessible Sink Cabinet (WI #154): Provide 1" minimum support at bottom edge of sink skirt. Provide 3" base width at freestanding leg of cabinet (refer to detail on the Drawings).
   7. Provide fillers at the tops of uppers, wall hung cabinets and full height cabinets to fill the void between the casework and the wall.

B. Cladding Materials:
   1. General:
      a. Laminate cladding: High-pressure plastic laminate; NEMA LD 3.
      b. Melamine overlay: Thermofused low-pressure melamine overlay.
   2. Exposed Surfaces:
      a. Horizontal surfaces: 0.050" laminate cladding.
      b. Vertical surfaces: 0.028" laminate cladding.
      c. Shelf, drawer, door and cabinet box edging: 3 mm solid-color PVC edging.
   3. Semi-Exposed Surfaces:
      a. Inside cabinet door surface: 0.028" laminate cladding.

b. Inside cabinet backs and sides: Melamine overlay.
c. Shelf tops and bottoms: Melamine overlay.
d. Drawer interior surfaces: Melamine overlay.
e. Shelf, drawer, door and cabinet box edging: 3 mm solid-color PVC edging.
f. All other locations: 0.028" laminate cladding.
g. Special Conditions: Clad backs and sides of cabinets in open knee spaces (i.e., handicap alcoves) with 0.028 laminate cladding to match exposed surface colors, unless noted otherwise.

4. Balance Sheets: Provide plastic laminate balance sheets of thickness required by manufacturer.
5. Colors:
   a. Laminate: As indicated on the drawings.
6. CBC Section 803.11: Laminated products factory-produced with a wood substrate shall comply with one of the following:
   a. The laminated product shall meet the criteria of CBC Section 803.1.1.1 when tested in accordance with NFPA 286 using the product mounting system, including adhesive, as described in Section 5.8 of NFPA 286.
   b. The laminated product shall have a Class A, B or C flame spread index and smoke-developed index, based on the requirements of CBC Table 803.13, in accordance with ASTM E84 or UL 723. Test specimen preparation and mountain shall be in accordance with ASTM E2579.
   c. Melamine: White.
   d. Shelf edging: Match shelf color for semi-exposed, match cabinet color for exposed.
   e. Door and drawer edging: Match plastic laminate color unless otherwise noted.
   f. Open bookcases: Match laminate on both exposed and semi-exposed surfaces.

2.3 LAMINATED PLASTIC COUNTERTOPS, SPLASHES

A. Grades: Comply with *North American Architectural Woodwork Standards Section 11 - Countertops*.
   1. Grade: Custom.

B. Cladding Materials: 0.050" horizontal high-pressure laminate; NEMA LD 3. If post formed laminate is used provide post form grade 0.42 laminate.
   1. CBC Section 803.11: Laminated products factory-produced with a wood substrate shall comply with one of the following:
      a. The laminated product shall meet the criteria of CBC Section 803.1.1.1 when tested in accordance with NFPA 286 using the product mounting system, including adhesive, as described in Section 5.8 of NFPA 286.
      b. The laminated product shall have a Class A, B or C flame spread index and smoke-developed index, based on the requirements of CBC Table 803.13, in accordance with ASTM E84 or UL 723. Test specimen preparation and mountain shall be in accordance with ASTM E2579.

C. Tops and Splashes:
   1. Construction: Fully formed
   2. Front edge:
      a. 180 degree wrap Full Round (3/4" radius).
      a. Hardwood bullnose (3/4" radius).
      b. Exposed ends: Self-edge.
   3. Backsplash:
      a. Type: Integral cove.
      b. Top edge: Waterfall. Self-edge ends.
      c. Height: Minimum 4" unless indicated otherwise on the drawings.
   4. End Splash (where indicated):
      a. Type: Square butt joint.
      b. Top edge: Self-edge coped to backsplash with self-edge ends held short of front edge.

c. No end splash is required when countertop abuts a plastic laminate cabinet side, provide matching color seam sealant at joint.
d. End splash shall be installed on top of the countertop; butting the countertop to the end splash is not acceptable.

5. Splicing: Countertop splices shall be no closer than 48" from a sink.
6. Exposed Edges: All exposed edges including sink and utility cut-outs shall be sealed with an opaque waterproof sealant.

D. Colors: As indicated on the Drawings.

2.4 SOLID SURFACE COUNTERTOPS, SPLASHES, AND SINKS

A. Standards: Comply with *North American Architectural Woodwork Standards Section 11 - Countertops*.

B. Tops and Splashes:

1. Material Thickness: 1/2”.
2. Front Edge:
   a. Type: Plain.
   b. Face height: 1-1/2".
3. Splash Height: Minimum 4" unless otherwise indicated on the drawings.
4. Color: As indicated on the Drawings.

C. Sinks:
1. Mounting: Underside.
2. Size: As indicated on the Drawings.
3. Color: As selected by the Architect from the manufacturer’s standard colors.
4. Plumbing brass and drains are specified in Division 15.

D. Manufacturers: Corian by Du Pont Polymers, Surell by Formica, Fountainhead by Nevamar, or Gibraltar by Ralph Wilson Plastics.

2.5 SHELVES

A. Shelf Thickness: Meet or exceed *North American Architectural Woodwork Standards Section 10 Material, Machining, and Assembly Rules:*
1. 50 psf load capacity for both fixed and adjustable shelves.
2. All shelve widths over 32” shall be constructed using 1” thick material.
3. Thickness of exposed shelves shall match the maximum required thickness of exposed shelves within the same room.

2.6 CABINET HARDWARE

A. Finish: US-26D finish where exposed unless otherwise specified.

B. Hardware Schedule:
1. Hinges: ANSI/BHMA A156.9 Grade 1, WI Grade 1; H08-9XG60 Institutional Hinge by Terry, or 370/450 Series Overlay Hinge by Rockford Process.
2. Doors & drawer pulls: Stanley #4483, Hafele #116.07.622; US 26D.
3. Door and drawer locks: National C8173/C8178, Olympus 100DR/200DW.
4. Regular Drawer slides: Full extension 100# rated, Accuride #7432.
5. File Drawer Slides: Full extension 100# rated, Accuride #3832.

6. Adjustable shelf clips: Hettich 016721 with locating pin, or Hafele 282.11.752 (with screw in each clip).
7. Wire Management Grommets: As manufactured by Doug Mockett & Co.
   a. Round grommets: EDP Series 2-1/2" diameter plastic with flip-top cap.
   b. Elongated grommets: King Kong Series with flip-top cap.
   c. Corner grommets: EDP Series 2-1/2" diameter plastic with flip-top corner cap.
   d. Color: Black.
8. Card Holder (CD-1): Brainerd Name Tag Holder, 2-1/2" x 1/2". Provide at each teacher mail slot.
9. Card Holder (CD-2): KV 701 Card Holder. Provide at each flat file drawer.
10. Flipper Door Slide: Accuride #1432 anti-rack cable system
11. Wardrobe hanger rod: Knape and Vogt KV660, length to fit. Wall supports; KV734 and KV735.
12. Magnetic Door Catch: All metal construction.

C. Key door and drawer locks alike by room. Provide a minimum of 6 keys per room. Key each room differently and provide 4 master keys.

2.7 COUNTERTOP SUPPORT BRACKETS

A. Unless otherwise specified, heavy duty workstation brackets: 1/8” steel construction, 1000 pound load rating per pair, texture powder coat finish, 18” x 18”. Secure to wall with 3/16” lag screws with 1.5” embedment into blocking.

B. Product: Item Number 72531 82 128 by US Futaba or approved equivalent.

2.8 STEEL LEGS

A. Steel Leg Assembly:
   1. Mounting Plate: 4-1/2" by 4-1/2" by 3/16" epoxy- coated steel plate with threaded stud and 6 screw holes for mounting to underside of countertop.
   2. Leg: 2-3/8" diameter steel leg, 1/16" wall thickness, satin nickel finish, with threaded insert anchoring to mounting plate.
   3. Foot: Pressed-in black plastic fitting with +1" of adjustment.

B. Product: #635.61.475 by Hafele.

2.9 STANDING AND RUNNING TRIM

A. Standards: Comply with *North American Architectural Woodwork Standards Section 6 - Interior and Exterior Millwork.*

B. Interior Trim for Transparent Finish:
   1. Grade: Premium.
   2. Species: White Oak.
   3. Shapes: As indicated on the Drawings.
   4. Finishes: As indicated on the Finish Schedule and as specified under Section 09 9100.

C. Interior Trim for Opaque Finish:
   1. Grade: Custom.
   2. Species: Maple or Birch.
   3. Shapes: As indicated on the Drawings.
   4. Finishes: As indicated on the Finish Schedule and as specified under Section 09 9100.

2.10 GLASS

A. Doors: 1/4" thick, clear, fully tempered glass; ground and polished edges where exposed to view.

B. Shelves: 3/8" thick, clear, fully tempered glass; edges ground and polished.

2.11 HARDBOARD

A. Pegboard: 1/4" thick, perforated, tempered hardboard pegboard by Masonite Corp.

B. Hardboard: 1/4" thick tempered hardboard by Masonite Corp.

2.12 LOUVERS

A. No. 672 Grille by Hart & Cooley or approved equal. Size as indicated on the drawings.

2.13 FABRICATION

A. Fabricate the work of this Section in strict accordance with the approved Shop Drawings and the WI construction requirements for the grade specified.

B. All toe space base boards shall be solid wood.

C. Construct bases with toe kicks as indicated on the Drawings at cabinet sides or ends.

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.

B. Pre-installation Meeting: Meet at project site prior to delivery of architectural woodwork and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Proceed with woodwork installation only when everyone concerned agrees that required ambient conditions can be maintained.

C. Verify adequacy and proper location of any required backing or support framing.

3.2 FIELD MEASUREMENTS

A. Take necessary measurements in the field to assure proper dimensions for the work of this Section.

3.3 INSTALLATION

A. Installation shall only occur after materials have been acclimatized for a minimum of 72 hours. NAAWS section 2.4.4.4.1 shall not apply.

B Install the work of this Section in strict accordance with the approved Shop Drawings and the referenced standards, anchoring all items firmly into position, as noted on Plans.

C. Install woodwork plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including tops); and with no variations in flushness of adjoining surfaces.

D. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
1. Edges of cut-outs subject to moisture shall be sealed with an opaque waterproof sealant, before trim, sink, etc. are installed.

E. Cabinets:
1. Install without distortion so that doors and drawers fit openings properly and are accurately aligned.
2. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.
3. Maintain veneer sequence matching (if any) of cabinets.
4. Provide felt silencers on backs of cabinet doors, minimum of 1 per door.
5. Fill openings at tops of cabinets created by scribes and trim.

F. Tops:
1. Anchor securely to base units and other support systems as indicated.
2. **Laminate plastic countertop butt splices are critical. Use same production lots and prematch joints to minimize color variation.**

G. Standing and Running Trim:
1. Install with minimum number of joints possible, using full length pieces from maximum length of lumber available.
2. Stagger joints in adjacent and related members.
3. Cope at returns, miter at corners, to produce tight fitting joints with full surface contact throughout length of joint.
4. Scarf end-to-end joints.

3.4 INSPECTION

A. Schedule WI CCP Inspection with at least 7 days prior notice to planned installation start. Notify the Architect and Inspector of the day and time at least 48 hours prior to the inspection.

END OF SECTION 06 4000

SECTION 07 1310 - SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide membrane waterproofing where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 31 2000: Earthwork.
3. Section 33 4610: Foundation drainage.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit 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.

1.3 QUALITY ASSURANCE

A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 10 years experience in the production and sales of self-adhesive sheet membrane waterproofing.

B. Installer: A firm which has at least 3 years experience in work of the type required by this section.

C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.

D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

1.4 SPECIAL WARRANTY

A. Manufacturer's Single-Source Warranty: Submit executed copy of manufacturer's material warranty for **5 years after date of Notice of Completion.**

B. Special Project Warranty: Upon completion of the Work and as a condition of its acceptance, deliver to the Architect two original copies of the following "Warranty and Maintenance Agreement", signed by the Contractor and the waterproofing subcontractor:
1. The undersigned hereby propose, and upon execution of this document by the Owner, agree for a period of 2 years after Substantial Completion of the Work to make immediate repairs as required to stop leaks or correct defects in the work of this Section, within 24 hours after receipt of notice from the Owner by telephone, telegram, or letter; and further agree to make such repairs without reference to or consideration of the cause or nature of such leaks or defects.

2. Repairs required within the stated period will be provided without cost to the Owner; except that repairs required consequent to an act of God, abuse, alterations, or failure of the substrata or the supporting structure (other than caused by defects in the work of this Section) will be paid for by the Owner promptly upon completion of the repair in each instance.
3. Repairs completed at Owner's cost shall be invoiced to the Owner at prevailing rates, and shall include an itemized breakdown of quantities plus unit cost for labor and materials, and shall include not more than 15% markup for overhead and profit.
4. This Warranty and Maintenance Agreement shall be in addition to the warranty requirements of the Contract Documents, and the enforcement of its provisions, shall not deprive the Owner of any action, right, or remedy otherwise available to him.

PART 2 - PRODUCTS

2.1 MEMBRANE WATERPROOFING

A. Substitutions: Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Sheet Membrane Waterproofing System: Self-adhesive, cold-applied composite sheet consisting of a thickness of 1.4 mm of rubberized asphalt and 0.1 mm of cross-laminated, high density polyethylene film specially formulated for use with water-based surface conditioner. No special adhesive or heat shall be required to form laps.
   1. Bituthene System 4000 Membrane by Grace Construction Products.

C. Prefabricated Drainage Composite: Hydroduct 220 by Grace Construction Products.
   1. Drainage composite shall be designed to promote positive drainage while serving as a protection course.

D. Miscellaneous Materials: Surface conditioner, mastic, liquid membrane, tape and accessories specified or acceptable to manufacturer of sheet membrane waterproofing.

2.2 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 OF SUBSTRATES

A. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to manufacturer of sheet membrane waterproofing.

B. Masonry Substrates: Apply waterproofing over concrete block with smooth trowel-cut mortar joints or parge coat.

C. Treat joints and install flashing as recommended by waterproofing manufacturer.

3.3 INSTALLATION

A. Apply surface conditioner at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of surface conditioner.

B. Delay application of membrane until surface conditioner is completely dry. Dry time will vary with weather conditions.

C. Seal daily terminations with troweled bead of mastic.

D. Apply drainage composite and related materials in accordance with manufacturer's recommendations.

E. Seal membrane terminations to substrate with termination bare and troweled bead of mastic.

END OF SECTION 07 1310

SECTION 07 1900 - WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide water repellent coatings applied to exterior masonry surfaces where indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Specifications Section 04 2900.
3. Specifications Section 09 9100.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.

B. Contract Closeout Submittals: Comply with requirements of Section 01 7700.
1. Manufacturer's recommended cleaning procedures.

1.3 CERTIFICATIONS

A. Manufacturer's Certification: Make required arrangements and pay the costs for a visit to the job site by an authorized representative of the manufacturer of the approved water repellent coating, who shall inspect and certify that:
1. The surfaces to which the water repellent coating was to be applied were in proper condition to receive that application;
2. The installers were properly trained in the manufacturer's recommended installation procedures and were prepared to use the application equipment recommended by the manufacturer; and
3. The materials delivered to the job were those approved by the Architect for the work of this Section.

1.4 SPECIAL WARRANTY

A. Upon completion of the work of this Section, and as a condition of its acceptance, deliver to the Architect 2 copies of a written warranty signed by the water repellent coating application subcontractor, and the water repellent coating manufacturer, and the Contractor under which:
1. The three parties mutually agree to maintain the water repellent coated surface free from the penetration of water for a period of two years following Date of Substantial Completion; and
2. The water repellent coating manufacturer agrees to provide water repellent coating materials as required for that purpose for a period of two years following Date of Substantial Completion; and
3. These warranty services will be provided at no additional cost to the Owner.
4. This special warranty is in addition to the warranty requirements of the Contract Documents and the enforcement of its provisions shall not deprive the Owner of any action, right, or remedy otherwise available to him.

PART 2 - PRODUCTS

2.1 MATERIALS

A. At the exterior face of all masonry and/or concrete building and planter walls, provide one of the following products or approved equal clear water repellent coating approved by the Architect.
   1. Chemstop Waterbase Heavy Duty by Tamms Industries Co.
   2. Deep Seal by Ven-chem Company, Inc.
   3. Monochem Aquaseal Heavy Duty by Monopole International Inc.
   4. Aqua-Trete by HULS America Inc.
   5. Substitutions: Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. 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.

B. If shrinkage cracks are apparent and/or excessive, notify contractor and have masonry cracks repointed prior to installation.

3.2 INSTALLATION

A. Apply sufficient coats of the approved material to achieve a consistent and uniform appearance, free from runs and sags, and with a uniformly resistive surface which will prevent penetration of water through the walls for the required period of warranty.

B. Contractor shall be responsible to insure the coordination of adjacent work to insure that:
   1. Application of sealer does not contact other finish surfaces, i.e., concrete walks, mow strips, plaster.
   2. That application of other materials, i.e., plaster, concrete, paint, do not contact finished sealed surfaces.

C. Cleaning of splatters, runs, overspray of the above items will be at the Contractor's expense.

3.3 TESTING AND INSPECTING

A. Application of water repellent coatings shall be done under the constant supervision of the Inspector of Record. Inspector shall verify application rate and uniformity.

B. Water test wall surfaces per manufacturers recommendations.

END OF SECTION 07 1900

SECTION 07 2100 - BLANKET INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide building insulation where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 03 3000: Rigid insulation under concrete slabs at walk-in freezer.
3. Section 05 4000: Cold formed metal framing.
4. Section 07 2210: Rigid insulation under asphalt shingle roofing.
5. Section 07 5110: Rigid insulation under built-up asphalt roofing.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.

PART 2 - PRODUCTS

2.1 BUILDING INSULATION MATERIALS

A. Fiberglass Insulation: Inorganic (non-asbestos) fibers formed with binders into resilient flexible blankets or semi-rigid batts; manufacturer's standard lengths and widths as required to coordinate with spaces to be insulated.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
1. Certain-teed Products Corp.
2. Johns Manville
3. Owens-corning Fiberglass Corp.
4. United States Gypsum Co.
5. FiberTek Insulation.
6. Substitutions: Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

C. Batt Width: Provide widths as required for flanged staple supported, nominal 16" or 24" for wood studs, or friction fit full 16" or 24" for metal studs, or cut to fit as required in other widths.

D. Support: Provide manufacturers recommended supporting systems as required for each installation. All insulation shall be continuously supported in a manner to permanently hold the insulation in place.
1. Wood framing shall be friction fit supported.
2. Metal framing shall be friction fit supported.

2. Support with RSA polypropylene biaxially oriented netting, 2-1/4" x 1-1/8" mesh.

F. Global Warming Potential: Light-density mineral wool board insulation material shall comply with CA Green Building Standards Code Table 5.409.3 and have a maximum acceptable GWP of 8.83 kg CO_2e/1 m^2.

2.2 INSULATION TYPES

A. Thermal Fiberglass Batts: ASTM C665, Type I.
1. Exterior walls concealed; R-19.
2. Exterior roof/ceiling concealed; R-30.
3. Flame spread - 25, smoke developed - 450; ASTM E84.
4. Combustion Characteristics: Pass; ASTM E136.
5. Recycled Content: Certified to contain minimum of 20% post-consumer and 5% pre-consumer recycled glass product, on average of manufacturer's products.

B. Sound Attenuation Fiberglass Batts: ASTM C665, Type I, full wall thickness.
1. Interior wall stud cavities, friction fit.
2. Flame spread - 25, smoke developed - 450; ASTM E84.
3. Combustion Characteristics: Pass; ASTM E136.
4. Recycled Content: Certified to contain minimum of 20% post-consumer and 5% pre-consumer recycled glass product, on average of manufacturer's products.

2.3 ACCESSORIES

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. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.

C. Impaling Clips: Galvanized steel clips with washer retainer and clips, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

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.

B. Remove, or protect against, projections in construction framing which may damage or prevent proper insulation.

3.2 INSTALLATION

A. Install the work of this Section in strict accordance with the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position.

B. Between Studs:
1. Install insulation tight in spaces and tight to exterior side of mechanical and electrical services with the plane of the insulation.

2. Leave no gaps or voids.
3. Trim insulation neatly to fit spaces.
4. Use wire or metal straps to hold insulation in place.

C. Between Wood Roof Rafters:
1. Install insulation tight in spaces and tight to exterior side of mechanical and electrical services with the plane of the insulation.
2. Leave no gaps or voids.
3. Trim insulation neatly to fit spaces.
4. Use wire or metal straps to hold insulation in place.

D. Between Wood I Joists: Wire up insulation under roof decks by running 16 or 18 gauge wire diagonally or perpendicular to the insulation every 18" to 24".

E. Underside of Roof Deck:
1. Retain insulation batts in place with impaling clips at 12" on center. Secure impaling clips as recommended by manufacturer.
2. Tightly abut adjacent insulation.

END OF SECTION 07 2100

SECTION 07 2120 - FOAM-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide closed-cell spray polyurethane foam where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer. Any repairs by a manufacturer approved contractor.

B. 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.

C. Fire Resistance Characteristics: As determined by testing identical products according to NFPA 285 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle foam-in-place insulation components in accordance with manufacturer’s written recommendations.

1.5 WARRANTY

A. Refer to manufacturer’s standard warranty terms (as applicable).

PART 2 - PRODUCTS

2.1 PERFORMANCE CHARACTERISTICS

A. Air Material Air Leakage Rate: Maximum material air leakage rate of less than 0.004 cfm/ft^2 under a pressure differential of 0.3 in w.g. (1.6 psf) (0.02 L/s/m^2 at 75 Pa) per ASTM E 2178 or E 282.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
2. Smoke-Development Index: 450 or less

C. Compressive strength: Minimum 26 psi (ASTM D1621).

D. Sustainability Requirements: Provide spray polyurethane foam insulation as follows:
   1. Low Emitting: Insulation tested according to CA/DPH/EHLB/v.1.1-2010.
   2. Resistant to fungal growth as per ASTM C1338.
   3. Containing no PBDE.

2.2 CLOSED-CELL SPRAY POLYURETHANE FOAM

A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 2.2 lb/ft3 and minimum aged R-value at 1-inch thickness of 4.9 per inch.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide ProSeal Eco by Icynene Inc.
   2. Substitutions: Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thickness recommended by manufacturer. Do not spray into rising foam.

D. Do not apply insulation within 3 inches of heat emitting devices or where the temperature is in excess of 200 degrees F, as per ASTM C411 or in accordance with applicable codes.

E. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.

F. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.3 PROTECTION

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

B. Thermal Protection: Protect installed spray polyurethane foam insulation with qualified thermal or ignition barrier per applicable building codes.

END OF SECTION 07 2120

SECTION 07 2700 - AIR BARRIER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Provide an air barrier system constructed to perform as a continuous air barrier and consisting of roof and wall assemblies sealed to the foundation, as indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 04 2900: Reinforced unit masonry.
3. Section 06 1000: Plywood sheathing.
4. Section 07 3110: Asphalt shingles.
5. Section 07 6200: Flashing and sheet metal.
6. Section 07 5110: Built-up asphalt roofing.
7. Section 07 9210: Elastomeric joint sealants.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit 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.

1.3 DEFINITIONS

A. Air Barrier: Air tight barrier made of materials that are relatively air impermeable but water vapor permeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.

1.3 AIR BARRIER SYSTEM DESCRIPTION

A. Provide a continuous air barrier that is designed and constructed to control air leakage into, and out of, the building's conditioned space. The air barrier shall be sealed at all joints for its entire length.

B. Air barrier shall be composed of one or more of the following:
1. Materials that have an air permeance not exceeding 0.004 cfm/ft^2 under a pressure differential of 1.6 psf; (0.02 L/s/m^2 at 75 Pa) ASTM E2178.
a. Materials deemed to comply with CEC Section 140.3(a)9A, with all joints sealed and all materials installed in accordance with the manufacturer's instructions, as listed in CEC Table 140.3-A.
2. Assemblies of materials that have an average air leakage not exceeding 0.04 cfm/ft^2 under a pressure differential of 1.57 psf; ASTM E2357, ASTM E1677, ASTM E1680 or ASTM E283.
a. Materials deemed to comply with Section 140.3(a)9B if all joints are sealed and all of the materials are installed as air barriers in accordance with the manufacturer's instructions, as follows:
1) Concrete masonry walls that have at least two coatings of paint or at least two coatings of sealer coating.
2) Concrete masonry walls with integral rigid board insulation.
3) Structural insulated panels.

4) Portland cement or Portland sand parge, or stucco, or a gypsum plaster, each with a minimum 1/2 inch thickness.

3. The entire building has an air leakage rate not exceeding 0.004 cfm/ft^2 at a pressure differential of 1.57 psf, when the entire building is tested, after completion of construction, in accordance with ASTM E779 or another test method approved by the Commission.

1.4 AIR BARRIER ASSEMBLIES DESCRIPTION

A. Air barrier materials and assemblies of materials indicated on the Drawings and specified herein are as follows:

B. Wood Stud Framed Walls with Plaster:
1. Cement plaster specified in Section 09 2400.
2. Plywood sheathing specified in Section 06 1100. All joints shall be over continuous solid blocking or shall be sealed with an approved air barrier tape.

C. Concrete Masonry Unit Walls:
1. Exterior insulation finish system specified in Section 07 2110.

D. Low Slope Wood Framed Roofs:
1. Built-up asphalt roofing specified in Section 07 5110.
2. Plywood sheathing specified in Section 06 1100.

E. Low Slope Wood Framed Roofs:
1. Built-up asphalt roofing specified in Section 07 5110.
2. Plywood sheathing specified in Section 06 1100.
3. Foam-in-place insulation specified in Section 07 2120.

F. Wood Framed Roofs:
1. Asphalt shingle roofing specified in Section 07 3110.
2. Plywood sheathing specified in Section 06 1100.
3. Foam-in-place insulation specified in Section 07 2120.

G. Continuity of air barrier system through attics and interstitial spaces is maintained using foam-in-place insulation as specified in this section.

H. Bridge and seal air leakage pathways and gaps, including but not limited to:
1. Connections of the walls to the roof air barrier.
2. Connections of the walls to the foundations.
3. Seismic and expansion joints.
4. Openings and penetrations of window and door frames, store front, curtain wall.
5. Piping, conduit, duct and similar penetrations.
6. Masonry ties, screws, bolts and similar penetrations.
7. Flashing and sheet metal assemblies.
8. All other air leakage pathways in the building envelope.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work of this Section with the work of other Sections for proper time and sequence to avoid construction delays.

B. Pre-installation Meeting: Convene pre-installation meeting a minimum of one week prior to starting framing to verify project requirements, substrate conditions and coordination with other building sub-trades, and to review manufacturer’s written installation instructions, if any.

1. Notify attendees 2 weeks prior to meeting and ensure meeting attendees include as minimum:
   a. Owner.
   b. Architect.
   c. Inspector.
   d. Air barrier material installers.
   e. Installers of framing, exterior sheathing, continuous insulation, roofing, metal wall panels, cement plaster, and electrical, plumbing and mechanical subcontractors as applicable.
2. Ensure meeting agenda includes review of methods and procedures related to insulation installation including coordination with related work.
3. Record meeting proceedings including corrective measures and other actions required to ensure successful completion of work and distribute to each attendee within 1 week of meeting.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

A. Closed-Cell Spray Polyurethane Foam: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas; ASTM C 1029, Type II; minimum density of 2.2 lb/ft^3 and minimum aged R-value at 1-inch thickness of 4.9 per inch.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide ProSeal Eco by Icynene Inc.
   2. Substitutions: Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Performance Requirements:
   1. Air Permeance: Maximum of 0.004 cfm/sf maximum (0.02 L/s/m^2 at 75 Pa): ASTM E2178.
   2. Water Vapor Permeance: Maximum 2 perm; ASTM E96, desiccant method.
   2. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Development Index: 450 or less
   3. Compressive strength: Minimum 26 psi (ASTM D1621).
   4. Sustainability Requirements:
      a. Low Emitting: Insulation tested according to CA/DPH/EHLB/v.1.1-2010.
      b. Resistant to fungal growth as per ASTM C1338.
      c. Containing no PBDE.

2.2 JOINT AND SEAM TAPE

A. Tape:
   1. 3M All Weather Flashing Tape #8067 or approved equal.

2.3 ACCESSORIES

A. Sealants and Accessories:
   1. As specified or as recommended by foam manufacturer.
   2. As specified in Section 07 9210.

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.

B. All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants detrimental to the adhesion of the membranes. Fill voids, gaps and spalled areas in substrate to provide an even plane. Strike masonry joints full-flush.

C. Curing compounds or release agents used in concrete construction must be resin based without oil, wax or pigments.

3.2 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Air Barriers: Install continuous air tight barriers, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants, tapes and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

3.4 FOAMED-IN-PLACE AIR BARRIER INSTALLATION

A. Comply with insulation manufacturer’s written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thickness recommended by manufacturer. Do not spray into rising foam. Minimum thickness of 2”.

D. Do not apply insulation within 3" of heat emitting devices or where the temperature is in excess of 200 degrees F, per ASTM C411 or in accordance with applicable codes.

E. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.

F. Miscellaneous Voids: Apply according to manufacturer’s written instructions.

3.5 FIELD QUALITY CONTROL

A. Allow access to air barrier work areas and staging.

B. Do not cover installed weather barriers until required inspections have been completed.

3.6 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION 07 2700

SECTION 07 3110 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide and install asphalt roof shingles where indicated on the Drawings, as specified herein, and as required for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 07 6200: Sheet metal flashing and trim.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.
3. Selection Samples: For each finish product specified, two complete sets of tile colors representing manufacturer's full range of available colors and patterns.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
1. A single installer ("roofer") shall perform the work of this section; and shall be a firm with not less than 5 years of successful experience in installation of specified roofing systems similar to those required for this project and which is acceptable to or licensed by manufacturer of primary roofing materials.
2. Installer's Field Supervision: Installer must maintain full-time supervisor/foreman on job site during times that roofing work is in progress. Supervisor must have minimum of five year's experience in roofing work similar to nature and scope to specified roofing.

B. UL Listing: Provide specified roofing system and component materials which have been tested for application and slopes indicated and are listed by Underwriters' Laboratories, Inc. (UL) for Class A external fire exposure.
1. Provide roof covering materials bearing Classification Marking (UL) on bundle, package or container indicating that materials have been produced under UL's Classification and Follow-Up Service.

C. Colors: Provide finish selections indicated in the Finish Schedule.
1. Acceptable Manufacturers: The products and manufacturer’s specified in the Finish Schedule are for purposes of color matching only. Refer to this Specification Section for additional manufacturers.
2. Manufacturer’s Standard Colors and Finishes: Where the Finish Schedule specifies a manufacturer’s standard color or finish, the Architect makes no guarantee that standard colors or finishes of other manufacturer’s (from the listing of acceptable manufacturers) will be acceptable. The Contractor shall be responsible for providing matching colors.

1.4 PRE-ROOFING MEETING

A. Not less than three nor more than ten calendar days prior to scheduled start of roofing installation, conduct a roofing substrata inspection and pre-roofing meeting at the job site.
1. Visually inspect all substrata upon which roofing is scheduled to be applied.
a. Determine general acceptability, and determine areas requiring further preparation.

b. Determine acceptable remedies for unacceptable areas.
2. Discuss proposed schedule for installation of the roofing, and reach agreement as to dates of start and finish of installation of the roofing.
3. Discuss product submittals and warranties.
4. Discuss interface with the work of other trades.
5. Discuss proposed methods for installation of the roofing, and equipment and personnel to be used.
6. Discuss inspection methods to be used.

1.5 SPECIAL WARRANTY

A. Manufacturer's Warranty: Submit executed copy of roofing manufacturer's standard "Limited Warranty" agreement, signed by an authorized representative of fiber glass shingle roofing system manufacturer, on form which was published with product literature as of date of Contract Documents, for **Limited Lifetime Warranty.**

B. Special Project Warranty: Upon completion of the Work and as a condition of its acceptance, deliver to the Architect two original copies of the following extended warranty, signed by the Contractor and the roofing subcontractor:
1. The undersigned hereby propose, and upon execution of this document by the Owner, agree for a period of 2 years after Substantial Completion of the Work to make immediate repairs as required to stop leaks or correct defects in the work of this Section, within 24 hours after receipt of notice from the Owner by telephone, telegram, or letter; and further agree to make such repairs without reference to or consideration of the cause or nature of such leaks or defects.
2. As a further condition of this 2-year Extended Warranty, the undersigned hereby agree to repair or replace any other damaged products and finishes damaged as a result of water penetration, to return the building to its original condition, and to notify the roof system manufacturer in writing within 30 days that such repairs were made.
3. Repairs required within the stated period will be provided without cost to the Owner; except that repairs required consequent to an act of God, abuse, alterations, or failure of the substrata or the supporting structure (other than caused by defects in the work of this Section) will be paid for by the Owner promptly upon completion of the repair in each instance.
4. Repairs completed at Owner's cost shall be invoiced to the Owner at prevailing rates, and shall include an itemized breakdown of quantities plus unit cost for labor and materials, and shall include not more than 15% markup for overhead and profit.
5. This Warranty shall be in addition to the warranty requirements of the Contract Documents and the enforcement of its provisions shall not deprive the Owner of any action, right, or remedy otherwise available to him.

PART 2 - PRODUCTS

2.1 ASPHALT SHINGLES

A. Self-sealing asphalt shingle with a fiberglass reinforced core and a mineral granule surfacing with architectural laminate styling for wood shake appearance.
1. Solar Reflective Index (SRI): 28 minimum.
2. Solar Reflectance (SR): 0.25 minimum.
3. UL 790 Class A rated.
4. Tested and labeled per ASTM D7158 or ASTM D3161.
5. ASTM D 7158, Class H.
6. ASTM D 3161, Class F.
7. ASTM D 3018, Type 1.
8. ASTM D 3462.
9. CSA A123.5.

B. Acceptable Products:
   1. Timberline® Cool Series Architectural Shingles by GAF.
   2. Landmark Solaris Gold Shingles by CertainTeed.
   3. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

C. Color: As selected by the Architect from the manufacturer's standard colors.

E. Solar Reflective Index: Minimum SRI of 75; or minimum solar reflectance of 0.63 and minimum thermal emmitance of 75.

2.2 UNDERLAYMENT

A. Membrane Underlayment: WIP 100 Granular-Surface Self-Adhering Roofing Underlayment by Carlisle, or approved equal meeting the requirements of ASTM D1970. At roofs with less than 4:12 slope (2:12 minimum) provide a second layer of underlayment as follows:
   1. Felt Underlayment: 30 lb., asphalt saturated, organic felt meeting the requirements of ASTM D226 Type II or ASTM 4869 Type IV.

2.3 OTHER MATERIALS

A. Hip and Ridge Shingles: High profile self-sealing hip and ridge cap shingle matching the color of selected roof shingle.

B. Starter Strip: Self-sealing starter course.

C. Asphalt Plastic Roofing Cement: ASTM D 4586, Type I or II.

D. 26 gauge galvanized "step flashing" at all curbs. Cover all step flashing with 22 gauge galvanized counter flashing.

E. Ice and Water Shield: Grace Ice & Water Shield where indicated at all curbs.

F. 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.

B. Verify that the deck is dry, sound, clean and smooth and free of depressions, waves, and projections. Cover all holes over 1" in diameter, cracks over 1/2" in width, loose knots and excessively resinous areas with sheet metal.

3.2 UNDERLAYMENT INSTALLATION

A. Membrane underlayment shall be applied in accordance with CBC Table 1507.1.1(2). Install shingle fashion in strict accordance with the manufacturer's written instructions in valleys, continuous at roof ridge and eaves, at all roof penetrations (HVAC, plumbing, electrical), and other locations indicated. At roofs with less than 4:12 slope provide a second layer of underlayment. Install per manufacturers recommendations.

3.3 SHINGLE INSTALLATION

A. Install underlayment, shingles, flashing, and other accessories in accordance with written instructions furnished by the shingle manufacturer.

B. Nails:
1. Use hot galvanized steel or aluminum sharp pointed conventional barb shank roofing nails with 3/8" flat head 12 gauge shank, meeting the requirements of ASTM F1667.
2. Nails are to be sufficient length to penetrate 3/4" into solid decking or through plywood sheathing. Do not overnail. Drive the nail until the head nearly touches the surface of the shingle.
3. **NAILS MUST FALL INTO THE OVERLAP AREA OF SHINGLE LAMINATE.**
4. Not less than 4 nails per strip shingle or 2 nails per individual shingle per CBC section 1507.2.7.

END OF SECTION 07 3110

SECTION 07 5110 - BUILT-UP ASPHALT ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide built-up asphalt roofing system where shown on the Drawings, as specified herein, and as needed for a complete and proper installation. Roofing system includes, but is not limited to:
   1. Roofing membrane and related flashings.
   2. Rigid insulation.
   3. Cover board.
   4. Fasteners, walk pads, and other accessories.

B. Related Sections:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
   2. Section 07 6200: Sheet metal flashing and trim.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
   1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
   2. Installation Procedures: Submit manufacturer's recommended installation procedures which, when approved by the Architect.
   3. Installer Certification: Obtain written certification from manufacturer of built-up roofing system certifying that Installer is approved by manufacturer for installation of specified roofing system for this project. Provide original signed copy of certification with submittal package.
   4. Shop Drawings: Indicate setting plan for tapered insulation, and mechanical fastener layout.

1.3 SYSTEM DESIGN

A. Wind Uplift: Meet or exceed the product and securement requirements of Factory Mutual Approval Guide and Loss Prevention Data 1-28, 1-29 and 1-48. Meet wind uplift securement requirements for **1-60** windstorm rating.

B. Solar Reflective Index: Minimum SRI of 75; or minimum solar reflectance of 0.63 and minimum thermal emmitance of 75.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. A single installer ("roofer") shall perform the work of this section; and shall be a firm with not less than 5 years of successful experience in installation of built-up roofing systems similar to those required for this project and which is acceptable to or licensed by manufacturer of primary roofing materials.
   2. Installer's Field Supervision: Installer must maintain full-time supervisor/foreman on job site during times that roofing work is in progress. Supervisor must have minimum of five year's experience in roofing work similar to nature and scope to specified roofing.

B. UL Listing: Provide built-up roofing system and component materials which have been tested for application and slopes indicated and are listed by Underwriters' Laboratories, Inc. (UL) for Class A external fire exposure.
   1. Provide roof covering materials bearing Classification Marking (UL) on bundle, package or container

indicating that materials have been produced under UL's Classification and Follow-Up Service.

1.5 PRE-ROOFING MEETING

A. Not less than three nor more than ten calendar days prior to scheduled start of roofing installation, conduct a roofing substrata inspection and pre-roofing meeting at the job site.
   1. Visually inspect all substrata upon which roofing is scheduled to be applied.
      a. Determine general acceptability, and determine areas requiring further preparation.
      b. Determine acceptable remedies for unacceptable areas.
   2. Discuss proposed schedule for installation of the roofing, and reach agreement as to dates of start and finish of installation of the roofing.
   3. Discuss product submittals and warranties.
   4. Discuss interface with the work of other trades.
   5. Discuss proposed methods for installation of the roofing, and equipment and personnel to be used.
   6. Discuss inspection methods to be used.

1.6 SPECIAL WARRANTY

A. Manufacturer's Warranty: Submit 2 executed copies of roofing manufacturer's standard **"No Dollar Limit"** agreement including flashing endorsement, signed by an authorized representative of built-up asphalt roofing system manufacturer, on form which was published with product literature as of date of contract documents, for **10 years after date of substantial completion.**
   1. Warranty includes roofing membrane, flashings, roofing membrane accessories, roof insulation, fasteners, substrate board, walkway products, manufacturer’s expansion joints, manufacturer’s edge metal products, and other single-source components of roofing system marketed by the manufacturer.

B. Special Project Warranty: Upon completion of the Work and as a condition of its acceptance, deliver to the Architect two original copies of the following Special Warranty, signed by the Contractor and the roofing subcontractor:
   1. The undersigned hereby propose, and upon execution of this document by the Owner, agree for a period of 2 years after Substantial Completion of the Work to make immediate repairs as required to stop leaks or correct defects in the work of this Section, within 24 hours after receipt of notice from Owner by telephone, telegram, or letter; and further agree to make such repairs without reference to or consideration of the cause or nature of such leaks or defects.
   2. As a further condition of this 2-year Special Warranty, the undersigned hereby agree to repair or replace any other damaged products and finishes, to return the building to its original condition, and to notify the roof system manufacturer in writing within 30 days that such repairs were made.
   3. Open seams, buckles, curled edges, fishmouths, splits, wrinkles, etc., will be considered as evidence of poor and/or defective workmanship and products.
   4. Repairs required within the stated period will be provided without cost to the Owner; except that repairs required consequent to an act of God, abuse, alterations, or failure of the substrata or the supporting structure (other than caused by defects in the work of this Section) will be paid for by the Owner promptly upon completion of the repair in each instance.
   5. Repairs completed at Owner's cost shall be invoiced to the Owner at prevailing rates, and shall include an itemized breakdown of quantities plus unit cost for labor and materials, and shall include not more than 15% markup for overhead and profit.
   6. This Special Warranty is in addition to the warranty requirements of the Contract Documents and the enforcement of its provisions shall not deprive the Owner of any action, right, or remedy otherwise available to him.

PART 2 - PRODUCTS

2.1 BUILT-UP ASPHALT ROOFING SYSTEM

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. As part of the work of this Section, provide all materials required by the roofing manufacturer for the specified special warranties, and the UL requirements specified.

C. All roofing, except sheet metal work, required for the roof system to be provided shall be manufactured by or approved in writing by the manufacturer of the roof system and such approved roofing shall be included in the roofing manufacturer's warranty.

D. Built-up roof in accordance with all requirements and installation procedures specified by the roofing manufacturer to issue the required warranty:

Built-up Roofing - Wood Deck and Insulated Deck			
Manufacturer	**Spec. Number**	**Ply Sheet**	**Cap Sheet**
Johns Manville	3CID	GlasBase Plus	GlasKap Plus
Malarkey	M3-WI-BBB-H	#501 Modified Base	#601 Cap
GAF	I-1-2-20/30FR	Ruberoid 20	Ruberoid 30 FR
Certainteed	HA-FR-N-B3	Flintlastic Base20	Flexiglas 960
MB Technology	I3HSCIOOGWH	LayflatSBS LF25	SupercapSBS SC100GWH

2.2 ROOF MATERIALS

A. Asphalt: ASTM D312, Type III (steep type) for slopes not greater than 3" per foot.

B. SBS Base Sheet: ASTM D4601, Type II; heavy asphalt-coated fiberglass mat.

C. SBS Cap Sheet: ASTM D3909; asphalt-coated mineral surfaced fiberglass sheet; coated with inert, noncombustible, opaque, ceramic coated granules.

D. Base Flashing: ASTM D3909, SBS-modified, composite polyester or glass fiber reinforced.

E. Fasteners:
1. Types as required and approved by the membrane manufacturer for the specific application, listed by UL, and approved by Factory Mutual for securing the roof system to the structural deck.
2. Fasteners: Meet or exceed Factory Mutual Standard 4470 for corrosion resistance.

2.3 COVER BOARD

A. Wood fiberboard: ASTM C208; composed of random laid wood fiber strands and primed on the mopping surface.

1. ASTM C208, Type 2, Grade 1.
2. Flame Spread Index: 75 or less, ASTM E84.
3. Smoke Developed Index: 450 or less, ASTM E84.
4. Board Thickness: 1/2".

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening cover board to roof deck.

2.4 INSULATION

A. Perlite Board: Expanded perlite, cellulosic fibers, binders and waterproofing agents with top surface seal-coated.
1. ASTM C728, Type 1.
2. Flame Spread Index: 75 or less, ASTM E84.
3. Smoke Developed Index: 450 or less, ASTM E84.
4. Compressive Strength: 20 psi.
5. Board Thickness: 3/4" minimum.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, provided by roofing system manufacturer; length as required for thickness of insulation material and penetration of deck substrate.

C. Tapered Insulation: ASTM C1289, provide factory-tapered insulation boards fabricated to slope of 1/4" in 12", unless otherwise indicated.

2.5 ACCESSORY MATERIALS

A. Flashing: Use at least 1 layer of ply sheet and 1 layer of cap sheet specified above.

B. Cant Strips: Preformed fiberboard.

C. Walkway Pads: Manufacturer's standard heavy-duty walkway pads.

D. Nailers: No. 2 or better lumber.
1. Pressure treated rot resistance; AWPA U1-07, Use Category UC2, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention.
2. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

E. 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.

F. Roof flashing, cants, and details are drawn to indicate intent only. Roofing subcontractor shall coordinate actual details and materials with roofing manufacturer to comply with roofing manufacturer's requirements for the specified warranty at no additional cost to the Owner. Submit details to the Architect for conceptual review.

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 GENERAL INSTALLATION

A. Mandatory Pre-roofing Inspection: Before starting application, the Roofing Contractor shall inspect the roof decks, accompanied by the General Contractor, Inspector of Record, the Architect's Representative, and Representative of Roof Manufacturer. Any defects shall be noted and corrected. All decks shall be smooth, dry and broom clean. Starting work by roofing contractor constitutes acceptance of the roof deck by him.

B. Install the work of this Section in strict accordance with pertinent requirements of governmental agencies having jurisdiction, and with the manufacturer's recommended installation procedures as approved by the Architect.

C. Drainage connections, metal edgings and all items affected by the roofing shall be on the job ready to be installed.

D. Verify that bitumen kettle has a thermometer in good working order.

E. At the end of each day, edge seal the finished portion of the roofing system completed that day, with fabric or felt set into hot bitumen or plastic cement.

3.3 INSULATION

A. Mechanically fasten each layer of insulation to deck to resist uplift pressure at corners, perimeter, and field of roof in accordance with roofing manufacturer's instructions.

B. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards.
   1. Lay subsequent layers of insulation with joints staggered minimum 6" from joints of preceding layer.
   2. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof. Fill gaps exceeding 1/4" with insulation.
   3. On metal deck, place boards perpendicular to flutes with insulation board ends bearing on deck flutes.
   4. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
   5. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 24 inches.

C. Do not apply more insulation than can be covered with membrane in same day.

3.5 COVER BOARD

A. Install cover board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt boards together.
   1. Stagger joints of board from insulation joints minimum of 6".
   2. Mechanically secure board to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturer's written instructions.

3.6 ROOF SYSTEM INSTALLATION

A. Base Sheet:
   1. Starting at the lowest point of the roof, with a full width piece, apply base sheet to the entire roof and up walls to a point 2" above all cants. Mechanically fasten and lap sheets in strict accordance with the manufacturer’s written instructions.

2. Lay sheets in shingle fashion so that direction of water flow is not against the laps. Lay sheets without wrinkles or buckles so that finished roof is free of pockets, blisters, wrinkles, buckles, splits, and curled edges.

B. Valleys and Waterways: Apply an additional layer of ply sheet to valleys and waterways prior to the application of roofing plies. Apply ply sheet in a solid mopping of asphalt at the nominal rate recommended by the manufacturer. Apply sheet 36" wide minimum and extend at least 8" up the inclines out of the valley.

C. Ply Sheets:
1. Starting at the lowest point of the roof, with a half width piece, apply base sheet to the entire roof and up walls to a point 2" above all cants in a solid mopping of asphalt, at the nominal rate recommended by the manufacturer. Lap sheets in strict accordance with the manufacturer's written instructions.
2. Lay sheets in shingle fashion so that direction of water flow is not against the laps. Lay sheets without wrinkles or buckles so that finished roof is free of pockets, blisters, wrinkles, buckles, splits, and curled edges.
3. Completely cover mopped sheets with mopping of asphalt, eliminate any sheet-to-sheet contact between mopped sheets and no dry contact permitted between a sheet and the substrate upon which it lies.

D. Cap Sheet:
1. Apply cap sheet after all curb and wall reinforcement is complete, starting at the lowest point of the roof. Apply cap sheet to the entire roof and up walls to a point 2" above all cants in a solid mopping of asphalt, at the nominal rate recommended by the manufacturer. Lap sheets in strict accordance with the manufacturer's written instructions.
2. Lay sheets in shingle fashion so that direction of water flow is not against the laps. Lay sheets without wrinkles or buckles so that finished roof is free of pockets, blisters, wrinkles, buckles, splits, and curled edges.
3. Do not permit asphalt exposure on top of adjacent sheet.

E. Base Flashing: Install base flashing in strict accordance with the manufacturer's written instructions for the application conditions using the materials specified.

3.7 CLEAN UP

A. Remove all bituminous materials or markings from the finished surface. Keep the roof and premises clean and free from accumulations of waste materials and rubbish at all times.

3.8 FIELD QUALITY CONTROL

A. During progress of the work of this Section, make visual inspections as necessary, and verify that:
1. All materials used comply with the specified requirements;
2. All materials are properly stored and handled;
3. Bitumen kettles are maintained at proper temperature;
4. Bitumens are applied uniformly, without voids or skips, and in the proper quantity;
5. The proper number and types of plies are installed, with the specified overlaps;
6. The proper number, type, and spacing of fasteners are used;
7. Associated flashings and sheet metal are installed in a timely manner in accordance with the specified requirements;
8. All elements of the work of this Section are completed on the same day and not installed in phases.

B. The Owner reserves the right to require test cuts to be made in the installed work of this Section.
1. Make such test cuts, when so directed by the architect, in dimension of 12" x 12", only at locations where directed by the architect.

2. Provide temporary protection at the site of test cuts as needed to prevent penetration of water until repairs are made or new roof system is installed.
3. Upon approval of the test cut sample, immediately repair the site of the test cut to the same degree of protection as is provided by the roofing system.

END OF SECTION 07 5110

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Provide flashing and sheet metal not specifically described in other Sections of these Specifications but required to prevent penetration of water through the exterior shell of the building.

B. Types of flashing and sheet metal work include, but are not limited to:
1. Metal copings.
2. Metal wall and counter-flashings.
3. Gutters, downspouts, and scuppers.
4. Metal trim/fascia units.
5. Miscellaneous sheet metal accessories.

C. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 07 3110: Asphalt shingles.
3. Section 07 5110: Built-up asphalt roofing.
4. Section 09 9100: Field painting of flashing and sheet metal.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Shop Drawings: Submit detailed drawings of layout, joining, profiles, terminations, and anchorages of fabricated work. Submit detailed drawings of special accessory components.
2. Samples: Submit 3 samples, each approximately 12" square, in colors specified.

1.3 QUALITY ASSURANCE

A. In addition to complying with pertinent codes and regulations, comply with pertinent recommendations contained in current edition of "Architectural Sheet Metal Manual" published by the Sheet Metal and Air-Conditioning Contractors National Association (SMACNA).

B. Standard commercial items may be used for flashing, trim, reglets and similar purposes provided such items meet or exceed the quality standards specified.

C. Colors: Provide finish selections indicated in the Finish Schedule.
1. Acceptable Manufacturers: The products and manufacturers specified in the Finish Schedule are for purposes of establishing color and quality. Refer to each Specification Section for additional manufacturers and Section 01 2500 for substitution requirements.
2. Manufacturer’s Standard Colors and Finishes: Where the Finish Schedule specifies a manufacturer’s standard color or finish, the Architect makes no guarantee that matching colors or finishes are available as other manufacturer’s “standard colors” from the listing of acceptable manufacturers. The Contractor shall be responsible for providing colors matching those indicated on the Drawings.
3. Custom Colors: Where the Finish Schedule indicates a specific manufacturer’s colors, other acceptable manufacturers shall provide matching custom colors where a standard color is not acceptable.

1.4 SPECIAL WARRANTY

A. PVDF (Polyvinylidene Fluoride) Coating Warranty: In addition to the warranty requirements of the Contract Documents, submit 2 original copies of coating applicator's 20-Year warranty. Warrant coating against peeling, blistering, chipping, checking, chalking in excess of a numerical rating of 8 when measured in accordance with ASTM D659, and fading and color change in excess of 5 NBS units when measured in accordance with ASTM D2244.2.

B. Special Project Warranty: Upon completion of the Work and as a condition of its acceptance, deliver to the Architect two original copies of the following Special Warranty, signed by the Contractor and the roofing subcontractor:
   1. The undersigned hereby propose, and upon execution of this document by the Owner, agree for a period of 2 years after Substantial Completion of the Work to make immediate repairs as required to stop leaks or correct defects in the work of this Section, within 24 hours after receipt of notice from the Owner by telephone, telegram, or letter; and further agree to make such repairs without reference to or consideration of the cause or nature of such leaks or defects.
   2. As a further condition of this 2-year Special Warranty, the undersigned hereby agree to repair or replace any other damaged products and finishes, to return the building to its original condition, and to notify the roof system manufacturer in writing within 30 days that such repairs were made.
   3. Repairs required within the stated period will be provided without cost to the Owner; except that repairs required consequent to an act of God, abuse, alterations, or failure of the substrata or the supporting structure (other than caused by defects in the work of this Section) will be paid for by the Owner promptly upon completion of the repair in each instance.
   4. Repairs completed at Owner's cost shall be invoiced to the Owner at prevailing rates, and shall include an itemized breakdown of quantities plus unit cost for labor and materials, and shall include not more than 15% markup for overhead and profit.
   5. This Special Warranty shall be in addition to the warranty requirements of the Contract Documents and the enforcement of its provisions shall not deprive the Owner of any action, right, or remedy otherwise available to him.

PART 2 - PRODUCTS

2.1 FLASHING MATERIALS

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Materials and Gauges: Where sheet metal is required, and no material or gauge is indicated on the Drawings, provide highest quality and gauge commensurate with the referenced standards. In no case shall sheet metal be less than 24 gauge.

C. Galvanized Steel Sheet Materials: ASTM A653, with G90 zinc coating; minimum 24 gauge except as otherwise indicated.

D. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gauge required for performance.

2.2 PREMANUFACTURED PARAPET COPING ASSEMBLIES

A. Coping Manufacturer: Subject to compliance with requirements, provide products by:
   1. R-Mer Edge Coping by Garland, 1-800-321-9336.
   2. Perma-Tite Coping by Metal-Era, 1-800-558-2162.
   3. Permasnap Coping by Hickman Engineered Systems, 1-828-676-1700.

4. Presto Lock Coping by Johns Manville, 1-800-445-1500.
5. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01620.

B. Performance Characteristics:
1. Pull-Off Resistance: Tested in accordance with SPRI ES-1 RE-3 to positive and negative design wind pressure as defined by CBC Section 1504.5.
2. Coping sections shall expand and contract freely while mechanically locked in place on anchor cleats.
3. Coping sections shall lock to anchor cleats by mechanical pressure from support chairs.
4. All coping cover joints shall be underlayed with gutter/support chairs capable of draining water.

C. Materials:
1. Coping: Formed steel sheet, galvanized, 24 gauge thick, minimum; factory finish PVDF coating
2. Anchor Cleat: 20 gauge galvanized steel, 12” wide, with coping support; cleat spaced at 5'-0”on center minimum, mechanically fastened as indicated.
3. Concealed Splice Plates: Material and finish to match coping, 8 inch” wide, with factory applied dual non-curing sealant strips or formed water channels.
4. Fasteners: Stainless steel screw type with a minimum pull-out resistance of 240 #; no exposed fasteners permitted.

D. Fabrication:
1. Factory fabricated to sizes required.
2. Factory fabricated mitered and welded corners, end caps, and wall terminations.
3. Factory formed to radius and arch where indicated.

2.3 PREMANUFACTURED REGLET ASSEMBLIES

A. Reglet Manufacturer: Subject to compliance with requirements, provide products by:
1. Springlock Flashing and Reglets by Fry Reglet Corp.
2. Snap-Tite System by Mm Systems Corp.
3. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01620.

B. Materials:
1. Reglet: 24 gauge galavanized steel; ASTM A653 with G90 zinc coating.
2. Counter Flashing: 24 gauge galavanized steel; ASTM A653 with G90 zinc coating; factory prefinished.
3. Provide prefabricated prefinished inside and outside corners, sealed watertight.

2.4 FABRICATED FLASHINGS

A. Fascia: Fabricate profile as indicated, 24 gauge minimum thickness.
1. 6" wide concealed back-up plate, formed to exact profile of fascia and secure plate in place prior to installation.
2. Install continuous bead of sealant each side of joint and set fascia in place leaving 1/4" space between sections.

B. Counterflashing in Masonry: Fabricate as 2-part unit consisting of counterflashing and receiver to profile as indicated; 24 gauge minimum thickness.
1. Build receiver into masonry work as work progresses.
2. Notch, lap, and seal receiver joints and corners.

3. Insert counterflashing into receiver immediately after roofing base flashing completion.
4. Fill insert joint between receiver and counterflashing with sealant.
5. Bend receiver lip down at 45 degree angle to furnish water drip.
6. Seal top of receiver at wall intersection with sealant.
7. Notch, lap, and seal counterflashing at inside corners and joints; notch and seam outside corners.

C. Exposed Gutters: Fabricate profile as indicted, 24 gauge minimum thickness.
1. Provide expansion joints with watertight joints.
2. Seal all joints with sealant.

D. Exposed Downspouts: Fabricate profile as indicted, 24 gauge minimum thickness.
1. Provide strainers with outlet tubes.

E. Stepped Flashing: 24 gauge minimum thickness.
1. Fabricate as indicated similar to SMACNA Figure 4-22A.

F. Crickets: 22 gauge minimum thickness.
1. Fabricate as indicated similar to SMACNA Figure 4-18, Detail 2.

G. Drip Edges: Fabricate as indicated, 24gauge minimum thickness.

H. Valley Flashing: 24 gauge minimum thickness.
1. Fabricate as indicated similar to SMACNA Figure 4-10.

I. Continuous Cleats: Form from same material as the unit which the cleat anchors, 20 gauge minimum thickness.

J. Termite Shields:
1. Fabricate as indicated similar to SMACNA Figure 4-24.
2. Install as detailed and set in continuous bead of liquid nails to concrete or masonry.
3. Lap joints shall be a minimum of 6" with a double row of continuous sealant.

2.5 FINISHES

A. Factory Finish PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; 70% Kynar 500 resin or Hylar 5000 resin.
1. 2-Coat Finish: Dry Film Thickness, ASTM D1400; 0.15 mil primer coat plus 0.70 mil color coat, 0.85 mil total minimum thickness.
2. Color: As indicated on the Finish Schedule.
3. Provide factory applied strippable plastic film for protection during fabrication and installation.

2.6 MISCELLANEOUS MATERIALS

A. Nails, Rivets, and Fasteners: Same metal as flashing/sheet metal or other noncorrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

B. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

C. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet

D. Roofing Cement: ASTM D 2822, asphaltic.

E. Epoxy Seam Sealer: 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior non-moving joints including riveted joints.

F. Solder: For use with steel provide 50-50 tin/lead solder (ASTM B32), with rosin flux.

G. 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.

2.7 FABRICATION

A. General: Fabricate in accordance with the SMACNA Architectural Sheet Metal Manual.
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. Shop fabricate work to the greatest extent possible.

B. Fabricate and form work to fit substrates. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

C. Fabricate to shapes indicated in 10'-0" lengths except where shorter lengths are required by construction or sheet size.

D. Corners: Shop prefabricate interior and exterior turns, and other changes in direction using epoxy seam sealer and rivets to rigidly secure the assembly and render watertight.

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 WORKMANSHIP

A. General: Comply with manufacturer's written instructions and with SMACNA Architectural Sheet Metal Manual, 2003 Edition. Anchor units securely in place by methods indicated, providing for expansion of metal units; conceal fasteners where possible; and set units true to line and level. Install work with laps, joints, and seams which will be permanently watertight and weatherproof.
1. Where lap seams are indicated, lap according to pitch, but not less than 3".
2. Make flat and lap seams in the direction of flow.

B. 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.

C. Separations:
1. Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

2. Where sheet metal work will be in contact with masonry, concrete, or stone, evenly coat contact surfaces with non-sagging mastic. Where sheet metal work will be embedded in mortar joints, evenly coat both sides with non-sagging mastic.

D. Embedment: Embed metal in connection with roofs in a solid bed of sealant, using materials and methods described in Section 07 9210 of these Specifications or other materials and methods approved by the Architect.

3.3 COPING INSTALLATION

A. Snap-On Coping Cap Detail:
1. Install miters first.
2. Position base flashing of the roofing membrane over the wall edge covering nailers completely, fastening 8" on center. Install membrane and cap sheet with proper material and procedure according to manufacturer's recommendations.
3. Install minimum 16 gauge, 16" long anchor chair at a maximum of 60" on center.
4. Install 6" wide splice plate by centering over 16" long by specified width anchor chair. Apply two beads of sealant to either side of the splice plate's center, approximately 2" from the coping cap joint. Install coping cap by hooking outside hem of coping on outside face of anchor chair. Press downward on inside edge of coping until "snap" occurs and hem is engaged on the entire chair.

B. Installing contractor shall check as-built conditions and verify the manufacturer’s coping details for accuracy to fit the wall assembly prior to fabrication. The installer shall comply with the coping manufacturer’s installation guide when setting copings.

C. Installer shall use mechanical fasteners with minimum 240 # (109 kg) pull-out resistance suitable for parapet substrates.

3.4 CLEANUP

A. After completion, clean all exposed work of scraps, stains, and dirt. After cleaning, wash with clean water and wipe dry.

END OF SECTION 07 6200

SECTION 07 7200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide roof accessories where shown on the Drawings, as specified herein, and as needed for a complete and proper installation. Roof accessories include, but are not limited to the following:
   1. Roof hatches.
   2. Automatic smoke vents.
   3. Roof curbs.

B. Related Sections:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
   2. Section 07 5110: Built-up asphalt roofing.
   3. Section 07 9510: Premanufactured expansion joint covers.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
   1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
   2. Installation Procedures: Submit manufacturers recommended installation procedures.

B. Contract Closeout Submittals: Comply with requirements of Section 01 7700.
   1. Operation and Maintenance manuals in accordance with requirements of Section 01 7820.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 ROOF ACCESS HATCH

A. Roof Hatch:
   1. Construction: 14 gage galvanized sheet metal.
   2. Finish: Factory prime coated for finish painting at the job site.
   3. Insulation: 1-1/2" rigid glass fiber, located on outside face of curb.
   4. Mounting: Provide frames and curbs suitable for mounting conditions indicated on the Drawings.
   5. Curb Height: 8" from finished surface of roof, minimum.
   6. Ladder Safety Post: At ladder access hatches; galvanized steel telescoping tubular section secured to ladder rungs that locks automatically when fully extended. Upward and downward movement controlled by a stainless steel spring balancing mechanism; Bilco Model LU-2 or approved equal.

B. Acceptable Ladder Access Products:
   1. J.L. Industries, Model RGH-1.
   2. Dur-Red, Model No. LH, 30" x 36".
   3. Nystrom, Model RHG, 30" x 36".
   4. Lane-Aire, Standard Rood Hatch, 30" x 36".
   5. Bilco, Type S, 30" x 36".

C. Acceptable Equipment Access Products:
   1. J.L. Industries, Model EHG, 72" x 96".
   2. Dur-Red, Model EH, 72" x 96".
   3. Nystrom, Model RHEG x D1T, 72" x 96".
   4. Lane-Aire, Model EH, 72" x 96".
   5. Bilco, Type D-20, 72" x 96".

D. Personal Fall Arrest/Restraint Anchorage: Required at all roof hatches and rooftop equipment when located within 10 feet of a roof edge or open side of a walking surface and when such edge or open side is located more than 30 inches above the floor, roof or grade below. In accordance with ANSI/ASSE Z359.1; OSHA 1926.502 compliant.
   1. At asphalt shingle roofing: Stainless steel single-D roof anchor for installation in a roof or vertical wall. Acceptable Products:
      a. RA41 Miller Permanent Roof Anchor.
   2. At built-up roofing: Single point anchor post that fastens through membrane, insulation and into metal sheathing, wood blocking or concrete. Acceptable Products:
      a. Miller Fusion Roof Anchor Post Permanent Roof Anchor. SKU X10030 or X10031 and all related accessories as required..

E. Hatch Rail System: Fiberglass reinforced polymer fixed safety railing system mounted to roof hatch flashing without penetrating roof membrane; OSHA 29 CFR 1910.23 compliant.
   1. Acceptable Products: Bilco Bil-Guard Hatch Rail System.

2.4 ROOF CURBS

A. Manufactured Curbs, Equipment Rails, Roof Mounting Assemblies: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counter-flashing, internal reinforcing, and top side and edges formed to shed water; as manufactured by The Pate Company, ThyBar Corporation, or Vent Products Inc.
   1. Construction: 14 gage galvanized sheet metal.
   2. Finish: Factory prime coated for finish painting at the job site.
   3. Insulation: 1-1/2" rigid glass fiber, located on outside face of curb.
   4. Wood Nailer: Preservative treated wood nailer along top of curb.
   5. Mounting: Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
   6. Curb Height: 8" from finished surface of roof, minimum.

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 INSTALLATION

A. Coordinate as necessary with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the manufacturers' recommendations as approved by the Architect, anchoring all items firmly into position for long life under hard use.

C. Put operating components through at least five complete operating cycles, adjusting as required, and achieving optimum ease of operation.

END OF SECTION 07 7200

SECTION 07 7220 - ROOF CURBS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide roof curbs where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 ROOF CURBS

A. Manufactured Curbs, Equipment Rails, Roof Mounting Assemblies: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counter-flashing, internal reinforcing, and top side and edges formed to shed water; as manufactured by The Pate Company, ThyBar Corporation, or Vent Products Inc.
1. Construction: 14 gage galvanized sheet metal.
2. Finish: Factory prime coated for finish painting at the job site.
3. Insulation: 1-1/2" rigid glass fiber, located on outside face of curb.
4. Wood Nailer: Preservative treated wood nailer along top of curb.
5. Mounting: Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
6. Curb Height: 8" from finished surface of roof, minimum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate as necessary with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the manufacturers' recommendations as approved by the Architect, anchoring all items firmly into position for long life under hard use.

END OF SECTION 07 7220

SECTION 07 8400 - FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide firestopping where shown on the Drawings, in all penetrations through fire rated walls, floors, and ceiling, and as specified herein, and as needed for a complete and proper installation. The Work of this Section includes, but is not limited to:
   1. Through penetration firestops and smoke stops for all fire-rated bearing and non-bearing wall and floor assemblies, both blank (empty) and those accommodating penetrating items such as cables, conduits, pipes, ducts, etc.
   2. Membrane penetration for fire-rated walls.
   3. Architectural/construction joint firestops within walls, floors, or the intersections of floors to exterior walls, or the intersection of top of walls to ceilings.
   4. Top of wall firestopping in all fire-rated partitions.

B. Related Sections:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
   2. Section 07 9210: Sealants and caulking.
   3. Section 22 0000: Plumbing.
   4. Section 23 0000: General Mechanical Provisions.
   5. Section 26 6000: General Conditions for Electrical Work.
   6. Section 27 0000: Communication Systems General.

C. Completely coordinate with work of all other trades.

D. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure and complete installation.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
   1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
   2. Installation Procedures: Submit manufacturers recommended installation procedures.
   3. UL Tested Systems: Submit drawings showing typical installation details for the methods of installation. Indicate which firestop materials will be used and thickness for different hourly ratings. Indicate construction of wall or floor assemblies, size, F-rating, T-rating, and remarks.
   4. Engineering Judgements: Submit manufacturer's drawings for all non-standard applications where no UL tested system exists. Indicate the "tested" UL system upon which the judgement is based so as to assess the relevance of the judgement to some known performance.

1.3 PERFORMANCE REQUIREMENTS

A. Firestopping Systems (Materials and Design):
   1. Conform to both Flame (F) and Temperature (T) ratings as determined by tests conducted in accordance with ASTM E814 in a configuration that is representative of field conditions.
   2. F ratings shall be a minimum of 1-hour but not less than the fire resistive rating of the assembly being penetrated.
   3. T ratings shall be based on measurement of the temperature rise on penetrating item(s).

B. Firestopping materials and systems shall be capable of closing or filling through-openings created by:
   1. The burning or melting of combustible pipes; cable jacketing, or pipe insulation materials, or;
   2. Deflection of sheet metal due to thermal expansion (electrical and mechanical ductwork).

C. Firestopping shall be flexible, allowing for normal pipe movement and shall not shrink upon drying as evidenced by cracking or pulling away from contact surfaces.

D. Firestopping shall be moisture resistant and shall not dissolve in water after curing.

E. Penetrations containing loose electrical, data, or communications cabling shall be protected using firestopping systems that allow unrestricted cable changes without damage to seal.

F. Materials shall not require ampacity derating in power cable installations.

PART 2 - PRODUCTS

2.1 FIRESTOPPING MATERIALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
   1. 3M Ceramic Materials
   2. Tremco
   3. Morgan Thermal Ceramics
   4. USG
   5. RectorSeal Corp.
   6. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Wall, Floor, and Ceiling Penetrations: ASTM E814.
   1. Provide systems designed specifically for the penetration condition, materials, and required fire rating.
   2. Through-penetration fire stops may be used for membrane penetrations.
   3. The F rating shall apply to all through-penetrations and shall not be less than the required fire-resistance rating of the assembly penetrated.
   4. The T rating shall apply to those through-penetration location required to have T ratings as specified in CBC Sections 714 and shall not be less than the required fire-resistance rating of the assembly penetrated.

2.2 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.

B. Verify that all pipe, conduit, cable, and other items which penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.2 INSTALLATION

A. Install the work of this Section in strict accordance with the original design, requirements of governmental agencies having jurisdiction, and the manufacturers recommended installation procedures to comply with the designated and required firestop rating.

B. Conditions Requiring Firestopping:
   1. General: Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designed as insulation, safing, or otherwise.
   2. Through-Penetrations: Install firestopping in all penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.
   3. Membrane-Penetrations: Where required by CBC Section 714, protect all membrane-penetrations in rated walls with firestopping.
   4. Construction Joints/Gaps: Provide firestopping:
      a. Between the edges of floor slabs and exterior walls.
      b. Between the tops of walls and the underside of floors.
      c. In the control joints in masonry walls and floors.
      d. In expansion joints.

C. Dam Construction: When required to properly contain firestopping materials within openings, damming or packing materials may be utilized. Combustible damming material shall be removed after appropriate curing. Noncombustible damming materials may be left as a permanent component of the firestop system.

END OF SECTION 07 8400

SECTION 07 9210 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Throughout the Work, seal and caulk joints where shown on the Drawings and elsewhere as needed to provide a positive barrier against passage of moisture and air.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 03 3000: Cast-In-Place Concrete.
3. Section 04 2900: Reinforced unit masonry.
4. Section 09 9100: Painting.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.
3. Samples: Submit samples of each sealant, each backing material, each primer, and each bond breaker proposed to be used. Provide minimum of 4 samples of each manufacturers standard color for each application. Provide sample of each installation type for Architect approval prior to beginning installation. Repeat samples until acceptable installation is approved by the Architect.

1.3 QUALITY ASSURANCE

A. Rejection of Installed Caulking and Sealants: Indication of lack of skill on the part of installers shall be sufficient grounds for rejection of installed caulking and to require its immediate removal and complete re-caulking at no additional cost to the Owner.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 6600.

B. Do not retain at the job site material which has exceeded the shelf life recommended by its manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Comply with VOC requirements of California Green Building Standards Code, Sections 5.504.4.1 and 5.504.4.2.

2.2 SEALANTS AND CAULKING

A. Silicone Sealant:
1. White Mildew Resistant: 786 White by Dow Corning, Sanitary 1700 White by General Electric, 863 White by Pecora.
2. General Exterior: 791 by Dow Corning, Silpruf by General Electric, 864 by Pecora, Spectrum 2 by Tremco.

B. Polyurethane Sealant:
1. General Use: DynaTrol II by Pecora, Dymeric by Tremco, Sikaflex-2c,NS/SL by SIKA.
2. Self-leveling Type: NR-201 by Pecora, Sonalastic SL1 by Sonneborn, Sikaflex 1cSL by Sika.

C. Acrylic Latex Sealant: AC-20+ Silicone by Pecora, Sonolac by Sonneborn.

D. Colors: Colors for each sealant installation will be selected by the Architect from standard colors normally available from the specified manufacturer.
1. In concealed installations use standard gray or black sealant.
2. Provide black sealant at glazing pockets.

2.3 ACCESSORY MATERIALS

A. Primers: Non-staining type, recommended by manufacturer to suit application.

B. Back-up Materials: Non-absorbent, non-staining, and specifically recommended for application by sealant manufacturer.

C. Bond Preventative Materials: Pressure sensitive tape recommended by sealant manufacturer to suit application.

D. Masking Materials: Appropriate masking tape which will effectively prevent application of sealant on surfaces not scheduled to receive it, removable without damage to substrate or staining.

E. Joint Cleaner: Non-corrosive, non-staining type recommended by sealant manufacturer; compatible with joint forming materials.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work will be performed. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Prepare all surfaces to receive sealants and caulking in strict accordance with the manufacturer's written requirements. Use solvents and primers where recommended by the manufacturer.

B. Clean all concrete joints, full depth free of debris and dust.

3.3 INSTALLATION

A. Install joint backing to achieve a neck dimension of no greater than 1/3 the joint width. Install in strict accordance with the manufacturer's written instructions.

B. Install bond breaker where joint backing is not used.

C. Mask adjacent surfaces to prevent contact of sealant with adjoining surfaces which would be stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape after tooling without disturbing joint seal.

D. Install sealant to manufacturer’s instructions.

E. Measure joint dimensions and size materials to achieve required width/depth ratios.

3.4 PRODUCT USAGE BY LOCATION

A. Where more than 1 type of sealant is listed, the Contractor may use either listed product that is best suited in accordance with the sealant manufacturer's written recommendations for the joint location and type and the surfaces to be sealed with particular attention given to prevent staining. Provide sealants and caulking as follows:
   1. Exterior, general use: Polyurethane or Silicone.
   2. Interior, wet areas: Mildew Resistant Silicone.
   3. Interior, general use and painting: Acrylic latex.
   4. Expansion and control joints, vertical and overhead surfaces: Polyurethane or Silicone.
   5. Expansion and control joints, horizontal surfaces: Self-leveling Polyurethane.
   6. Interior concrete slab (where slab is finished floor, fill all crack control joints): Polyurethane.
   7. Exterior concrete walks and courts (where indicated on the plans): Polyurethane.
   8. Horizontal surfaces, traffic: Self-leveling Polyurethane.
   9. Glazed tile and/or masonry: Polyurethane or Silicone.
   10. Plumbing fixtures: Mildew Resistant Silicone.
   11. Glazing to metal frame: Black Silicone.

3.5 CLEANING AND REPAIRING

A. Clean adjacent soiled surfaces.

B. Repair or replace defaced or disfigured finishes caused by sealant work.

END OF SECTION 07 9210

SECTION 08 1110 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide hollow metal doors, and hollow metal door and window frames, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 08 7100: Hardware requirements and templates.
3. Section 08 8100: Glass for vision panels, sidelights, and windows.
4. Section 09 9100: Field Painting

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.
3. Shop Drawings: Submit details of each frame type, elevations of door designs, details of openings, and details of construction, installation, and anchorage.

1.3 QUALITY ASSURANCE

A. Provide all products of this Section from a single manufacturer.

B. Comply with ANSI/SDI A250.8-2003 and HMMA 861-14.

1.4 FIRE AND SMOKE RATINGS

A. Fire and Smoke Rated Door Assemblies: Where fire-rated or smoke-rated assemblies are indicated or required, provide door and frame assemblies that have been tested, listed, and labeled by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.
1. Side-hinged or Pivoted Swinging Doors: UL 10C.
2. Doors in Fire-rated Corridors and Smoke Barriers: 20 minute fire protection rating; UL 10C without hose stream test.
3. Door in Exit Enclosures and Exit Passageways: UL 10C; maximum transmitted temperature end point of not more than 450̊F above ambient at end of 30 minutes of standard fire test exposure.
4. Smoke and Draft Control Doors: UL 10C and UL 1784.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
1. Steelcraft, (805) 837-4111.
2. Stiles Custom Metal, Inc., (209) 538-3667.
3. Ceco Door Products, (510) 489-1700.

4. Curries, (559) 432-5537.
5. Security Metal Products, (310) 641-6690.
6. Metal Manufacturing Co., (916) 922-3484.
7. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 METAL DOORS

A. Exterior Flush Doors:
   1. ANSI/SDI A250.8, Level 3, Model 2 (seamless), minimum 16 gauge (0.067") faces.
   2. Top Closure: 16 gauge flush end channel closure with seal against moisture entry.
   3. Bottom Closure: 16 gauge recessed end channel with drainage openings.
   4. Galvanizing: Hot-dipped zinc coating; ASTM A653 with A60 or G60 coating.
   5. Reinforce doors internally with 18 gauge steel hat section ribs.
      a. Weld reinforcing to each door face with spot welds to faces spaced 4" on center.
      b. Ends of ribs welded together full width of the supporting web span.
      c. Insulate space between ribs with 2 lb. density polyurethane bonded to both faces; ASTM C591.
   6. Reinforce for finish hardware provided under Section 08 7000; ANSI/SDI A250.8.

B. Exterior Stile-and-Rail Doors: Unitized, true tube type construction with joints continuously welded and ground smooth.
   1. ANSI/SDI A250.8, Level 3, Model 3, minimum 16 gauge (0.067") faces.
   2. Core: 2 lb. density polyurethane bonded to both faces; ASTM C591, U-factor of 0.10.
   3. Top Closure: Flush end channel closure with seal against moisture entry.
   4. Bottom Closure: Recessed end channel with drainage openings.
   5. Galvanizing: Hot-dipped zinc coating; ASTM A653 with A60 or G60 coating.
   6. Reinforce for finish hardware provided under Section 08 7000; ANSI/SDI A250.8.

C. Interior Doors: Full flush or stile-and-rail design as indicated.
   1. ANSI/SDI A250.8, Level 3, Model 2 (seamless), minimum 16 gauge (0.053") faces.
   2. Core: 2 lb. density polyurethane bonded to both faces; ASTM C591, U-factor of 0.10.
   3. Galvanizing: Hot-dipped zinc coating; ASTM A653 with A60 or G60 coating.
   4. Reinforce for finish hardware provided under Section 08 7000; ANSI/SDI A250.8.

D. Finish:
   1. After fabrication, fill all tool marks and surface imperfections, sand and dress smooth.
   2. Grind, fill, and dress all weld joints.
   3. Coat surface with factory primer for field finishing; ANSI/SDI A250.10.

2.3 METAL FRAMES

A. Type and Design:
   1. Provide frames in the dimensions and types shown on the Drawings, non-labeled or labeled as indicated, in 16 gauge (0.053") for interior frames and 14 gauge (0.067") for exterior frames.
   2. Galvanizing: Hot-dipped zinc coating; ASTM A653 with A60 or G60 coating.
   3. **Face welded construction.**
   4. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames.
   5. Reinforce for finish hardware provided under Section 08 7000; ANSI/SDI A250.8.
   6. Frames Wider than 48": Reinforce with steel channel fitted tightly into frame head, flush with top.
   7. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.

B. Finish:
1. After fabrication, fill all tool marks and surface imperfections, sand and dress smooth.
2. Grind, fill, and dress all weld joints.
3. Coat surface with factory primer for field finishing; ANSI/SDI A250.10.
4. Remove all areas of rust to bare metal; reprime prior to finish paint.

C. Frame Anchors:
1. Wood Stud Anchor: 18 gauge galvannealed steel, "lock-in" type.
2. Closed Metal Stud Wall Anchor: 18 gauge galvannealed steel, "lock-in" or factory welded type.
3. Wire Masonry Anchors: 3/16" diameter wire, "lock-in" type.
4. Masonry T-Anchors: 18 gauge galvannealed steel, "lock-in" type.
5. Existing Wall Anchor: 18 gauge galvannealed steel, "lock-in" or factory welded type.
6. Base Anchor: 16 gauge galvannealed steel, welded-in or adjustable; provide a minimum of 2 fasteners in each anchor.
7. Mullion Base Anchor: 16 gauge galvannealed steel, mullion slides over; provide a minimum of 2 fasteners in each anchor.
8. Corner Post Base Anchors: 12 gauge galvannealed steel, corner post slides over; provide a minimum of 2 fasteners in each anchor.

2.4 FINISH HARDWARE

A. Coordinate anchorage hardware and secure templates from the finish hardware supplier.

2.5 ACCESSORIES

A. Removable Glazing Stops (at window frames only):
1. Formed 20 gauge (0.032") sheet steel, butted corners; secured to frame with countersunk #6 zinc-coated tamper-proof screws.
2. Chemically treat and paint with a rust inhibitive primer all metal surfaces to which glazing stops are secured and the inside of the glazing stops to installation.

B. Glazed Light Frames:
1. 20 gauge (0.042") cold rolled steel frame, tightly mitered corners. At exterior locations, provide galvanized frames. Locate screws on room side.
2. Provide labeled frames at fire rated assemblies.
3. Finish: Factory baked enamel; custom color as selected by the Architect.
4. Model LoPro (LoPro-IS where required due to glazing thickness) by Anemostat or approved equal.

C. Interior Door Louvers:
1. 18 gauge (0.042") cold rolled steel frame, tightly mitered corners, inverted Y non-vision louver, 50% free area. Locate screws on inside side.
2. Prime finish for field painting under Section 09 9100.
3. Model AFDL by Anemostat or approved equal.

D. Exterior Door Louvers:
1. 18 gauge (0.042") cold rolled galvanized steel frame, tightly mitered corners, 22 gauge galvanized internal louver, 50% free area. Locate screws on inside side.
2. Prime finish for field painting under Section 09 9100.
3. Model AFDL by Anemostat or approved equal

E. Transom Louvers:
1. 18 gauge (0.042") cold rolled steel frame, tightly mitered corners, inverted Y non-vision louver, 50% free area. At exterior locations, provide galvanized frames and attached mesh insect screens. Locate screws

on inside side.
2. Prime finish for field painting under Section 09 9100.
3. Model AFDL-T by Anemostat or approved equal.

2.6 PREPARATION FOR HARDWARE

A. Coordinate anchorage hardware and secure templates from the finish hardware supplier.

B. Reinforcement: Reinforce components for hardware installation in accordance with ANSI/SDI A250.8 except where more stringent requirements are called for within this specification.
1. Provide box or channel type lock and closer reinforcements, continuous from top to bottom of door and welded to face sheets.

C. Punch single leaf frames to receive 3 silencers; provide one silencer per leaf at the head of double leaf frames unless gasketing is specified for that specific opening.

D. Factory prepare hardware locations in accordance with Section 08 7100.

E. Plaster Guards: 26 gauge galvanized steel plaster/dust guards, welded to frame at finish hardware cutouts where mortar, plaster, dust or other materials might obstruct hardware operation and to close off interior of openings.

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 FIRE RATED ASSEMBLIES

A. Install fire-rated doors and frames in accordance with their listings and NFPA 80.
1. Install smoke and draft control doors in accordance with NFPA 105.

3.3 FRAME INSTALLATION

A. Install frames and doors in accordance with the manufacturer's written recommendations and ANSI/SDI A250.8.

B. Set welded frames in position prior to beginning metal stud partition work; brace frames until permanent anchors are set.

C. Set anchors for frames as work progresses. Install anchors at hinge and strike levels. Place frames prior to construction of enclosing walls and ceilings; provide minimum 3 anchors per jamb at hinge and strike locations.
1. Where indicated in the plans, secure frames in place with screw fasteners at frame anchors to wall framing or post-installed expansion anchors at masonry and concrete. Countersink fasteners, fill with body putty, sand smooth and flush with no voids or ridges. Conceal installed fasteners so as to be invisible at exposed faces.

D. Set frames accurately into position, plumbed (within 1/8" in 10'), aligned, and braced securely until permanent anchors are set.

1. Use temporary setting spreaders at all locations. Use intermediate spreaders to assure proper door clearances and header braces for grouted frames.

3.4 DOOR INSTALLATION

A. Install doors per manufacturer's recommendation.

B. Install hollow metal doors in frames using hardware specified in Section 08710 Finish Hardware.

C. Clearances at edge of doors.
1. Between door and frame at head and jambs: 1/8".
2. At meeting edges pairs of doors and at mullions: 1/8".
3. At sills without thresholds: 5/8" maximum above finish floor.
4. At sills with thresholds: 1/8" above threshold.

3.5 ADJUST AND CLEAN

A. Remove dirt and excess sealants, mortar or glazing compounds from exposed surfaces.

B. Final Adjustments: Adjust moving parts for smooth operation.
1. Check and readjust operating finish hardware items in hollow metal work just prior to final inspection.
2. Leave work in complete and proper operating condition.
3. Remove defective work and replace with work complying with the specified requirements.

C. Immediately after erection, sand smooth all rusted and damaged areas of prime coat, and apply touchup of compatible air-drying primer submitted by the manufacturer.

D. Fill all dents, holes, etc. with metal filler, sand smooth and flush with adjacent surfaces - reprise and paint to match specified finish.

END OF SECTION 08 1110

SECTION 08 1400 - WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide wood doors where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications
2. Section 08 1110: Hollow metal doors and frames.
3. Section 08 7100: Hardware requirements.
4. Section 08 8000: Glazing for vision panels.
5. Section 09 9100: Field finishing of wood doors and metal vision panel frames and door louvers.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.
3. Submit door manufacturer's technical data for each type of door, including details of core and edge construction, trim for openings and louvers, and factory-finishing specifications.
4. Samples: Submit 12 samples, (6 to be submitted to painter for finish samples), approximately 8" x 8" in size, of each of the proposed door face materials representing typical range of color and grain for each species of veneer required.

1.3 QUALITY ASSURANCE

A. In addition to complying with pertinent codes and regulations of governmental agencies having jurisdiction, comply with:
1. "Manual of Millwork" of the Woodwork Institute, for the grade or grades specified.

B. Manufacturer: Obtain doors from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 6600.

B. Delivery:
1. Deliver doors to the job site after plaster and cement are dry, and after the building has reached average prevailing humidity of its locality.
2. Deliver prefinished doors in manufacturer's original containers, clearly marked with manufacturer's name, brand name, size, thickness, and identifying symbol on the covering.
3. Seal all four edges of unfinished doors when delivered to the job site.

C. Storage:
1. Stack flat on 2" x 4" lumber, laid 12" from ends and across center.
2. Under bottom door and over top and sides of stack, provide plywood or corrugated cardboard to protect

door surfaces.
3. Store doors in area where there will be no great variations in heat, dryness, and humidity.

D. Do not drag doors across one another; lift doors and carry them into position.

1.6 SPECIAL WARRANTY

A. In addition to the warranty requirements of the Contract Documents, provide 2 original copies the manufacturer's written **Lifetime Warranty.**

PART 2 - PRODUCTS

2.1 GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Provide flush wood doors of the types, designs, and thicknesses shown on the Door Schedule in the Drawings, labeled or non-labeled as indicated and required, and in solid core or hollow core as shown on the Door Schedule.

C. Grade: Except as may be shown otherwise on the Drawings, fabricate the work of this Section to "PREMIUM GRADE" standards of the referenced WI, Door Face Characteristics.

D. Plastic Laminate Veneer:
1. Grade: Premium
2. Laminate Face: High-pressure decorative laminate complying with NEMA LD 3, Grade HGS.
3. Stiles: Plastic-laminate matching faces, applied before faces.
4. Refer to Door and Finish Schedules for colors, patterns, and finishes.

2.2 INTERIOR WOOD DOORS

A. Non-Rated Solid Core Doors: Flush, 5-ply, 1-3/4" thick, 1-1/4" laminated hardwood stiles, 1-1/4" softwood rails and lock blocks, crossbanded 1/16" thick minimum, with particleboard core complying with ANSI A208.1, Grade LD-2.
1. Architectural Solid Core (APC-3) by Haley.
2. Particleboard Door by Eggers Industries.
3. Particleboard Core Door (DPC-1) by Weyerhaeuser.
4. Particleboard Door by Pacific Architectural Wood Products.
5. Flush Wood Veneer Doors (PC-5 or SCLC) by VT Industries.
6. GPD-PC Architectural Door by Graham Wood Doors.

2.3 VISION PANEL OPENINGS

A. Wood Beads:
1. Non-rated Doors: Hardwood bead matching species of face veneer.
2. Fire-rated Doors: Manufacturer's standard fire-rated wood-veneer beads matching species of face veneer.

2.4 DOOR LOUVERS

A. Door Louvers:
1. 18 gage (0.042") cold rolled steel frame, tightly mitered corners, inverted Y non-vision louver, 50% free area. At exterior locations, provide galvanized frames. Locate screws on inside side.
2. Prime finish for field painting under Section 09 9100.
3. Model AFDL by Anemostat or approved equal.

2.5 FABRICATION

A. Openings: Cut and trim openings through doors to comply with applicable requirements.

B. Provide proper blocking for every surface applied piece of hardware. No sex bolt or through bolt application of hardware will be allowed.

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 INSTALLATION

A. Fitting and Machining:
1. Unless doors are completely fitted and machined at the mill, fit them for width by planing and fit them for height by sawing:
a. Bottom: 1/2" clearance maximum.
b. Top: 1/8" clearance maximum.
c. Lock edge and hinge edge: Bevel 1/8" in 2" maximum.
2. Machine doors for hardware in accordance with recommendations of the hardware manufacturers, as those recommendations have been approved by the Architect.
3. Seal cut surfaces after fitting and machining.

B. Install doors to comply with manufacturer's written instructions and referenced WIC standards.

C. Replace or rehang doors which are hinge bound and do not swing or operate freely.

3.3 COMPLIANCE

A. The Owner reserves the right to request and pay for an inspection by a representative of the referenced organization to determine that the work of this Section has been performed in accordance with the specified standards.

B. In the event such inspection determines the work of this Section does not comply with the specified requirements, immediately remove the non-complying items and replace them with items complying with the specified requirements, all at no additional cost to the Owner, and reimburse the Owner for the cost of the inspection.

END OF SECTION 08 1400

SECTION 08 3100 - ACCESS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide ceiling and soffit access door where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
   1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
   2. Installation Procedures: Submit manufacturer's recommended installation procedures.

1.3 EXTRA MATERIALS

A. Keys: Provide for the Owner's use, 1 complete set of all tools and keys for each door that come packaged with the doors. Provide identification tag with each door key indicating key location.

B. Deliver keys to the Inspector of Record. Obtain and forward to the Architect, a signed receipt from the Inspector accepting delivery.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 CEILING/SOFFIT ACCESS DOORS

A. Non-Rated Flush Ceiling / Soffit Access: Access units with flanged frame flush with gypsum board and plaster ceilings and soffits:
   1. Construction: 14 gage steel door and flanged frame.
   2. Finish: Factory primed for painting on the job site.
   3. Locking: Provide each unit with cylinder locks and two keys per unit.
   4. Size: 22" by 36".
   5. Acceptable products:
      a. Model TM by J.L. Industries.
      b. Model DSC-214M by Karp Associates.
      c. Model L-DW by Larsen's Manufacturing.
      d. Style M by Milcor.
      e. Model NT by Nystrom.
      f. UF-5000 by Acudor Access Doors.

2.3 WALL ACCESS DOORS:

A. Provide wall access doors where needed for access to mechanical and electrical installations, and where indicated on the drawings.

B. Non-Rated Flush Wall Access: Access units with flanged frame flush with gypsum board or plaster assemblies.
1. Rating: Provide access doors having the same fire rating as the surface being pierced.
2. Construction: 14 gage steel door and frame, with self-closing and latching spring closer.
3. Finish:
   a. For gypsum board and plaster surfaces, factory primed for painting on the job site.
   b. For tile surfaces and toilet rooms, stainless steel with satin finish.
4. Locking: Provide each unit with cylinder locks and two keys per unit.
5. Size: As required, 12"x12" minimum.
6. Acceptable products:
   a. Model TM by J.L. Industries.
   b. Model DSC-214M by Karp Associates.
   c. Model L-MPG by Larsen's Manufacturing.
   d. Style M by Milcor.
   e. Model NT by Nystrom.
   f. UF-5000 by Acudor Access Doors.

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 INSTALLATION

A. Coordinate as necessary with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the manufacturers' recommendations as approved by the Architect, anchoring all items firmly into position for long life under hard use.

C. Put operating components through at least five complete operating cycles, adjusting as required and achieving optimum ease of operation.

END OF SECTION 08 3100

SECTION 08 3300 - COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide overhead coiling doors where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 11 4000: Stainless steel sills at counter doors.
3. Division 26: General electrical requirements and connections to fire alarm.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures which will become the basis for accepting or rejecting actual installation procedures used on the Work.
3. Shop Drawings: Submit detailed drawings showing fabrication, installation, anchorage, and interface of the work of this Section with the work of other trades. Submit detailed drawings of special accessory components not included in manufacturer's product data.

B. Contract Closeout Submittals: Comply with requirements of Section 01 7700.
1. Operation and Maintenance manuals in accordance with requirements of Section 01 7820.

1.3 QUALITY ASSURANCE

A. Construct labeled fire doors in accordance with testing agency requirements for the rating required.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products by:
1. The Cookson Company, (559) 291-5537.
2. Cornell Iron Works, (916) 723-4919.
3. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 INTERIOR STAINLESS STEEL SERVICE DOORS

A. Curtain: Interconnecting non-insulated slats, 2-3/4" nominal height, Type 304 stainless steel of metal gage recommended by door manufacturer to meet 5 psf wind loading, No. 4 finish.

B. Bottom Bar:
1. Labeled Doors: 2 stainless steel angles, finish to match door.

2. Safety Edge: 2 stainless steel angles, finish to match door, with a sealed assembly with vinyl-coated nylon casing containing electric contacts. Activation of this device stops downward movement of door and causes door to return to full open position.

C. Guides: Stainless steel angles, finish to match door curtain, of size and thickness required by door size, location and use, wind loading, and UL label. Flare top of guides for curtain entry.

D. Brackets: Steel plate, minimum of 1/4" thick, bolted to wall angle; factory finish to match door curtain.

E. Hood: Fabricated from 24 gage minimum thickness stainless steel, formed to fit curvature of brackets, finished to match door curtain.

2.3 DOOR ASSEMBLY

A. Barrel: Steel pipe supporting curtain and encasing torsion spring, designed for maximum deflection of 0.03" per foot of span and supported by grease-sealed ball bearings each end. Provide 5/16" thick steel support bracket each end.
1. Provide stainless steel end covers on stainless steel counter door support brackets.

B. Spring Counter Balance: Oil-tempered, heat-treated steel helical torsion springs bound in barrel and connected to torsion adjusting wheel. Access to adjusting wheel shall not require removal of hood.

2.4 OPERATION

A. Operation Required:
1. Interior Service Doors: Electric motor operated.

B. Service Door - Motor Operated:
1. Gearhead motor recommended by door manufacturer, UL listed conforming to NEMA standards, removable without affecting emergency hand chain operation or limit switch setting.
   a. Speed: 2/3 foot per second.
   b. Drip-proof electric motor with gear reducer in oil bath.
2. Provide reversing contactor and limit switch for controlling raising and lowering of curtain. Provide protection device preventing damage from overcurrent and locked motor conditions.
3. Provide electrically interlocked emergency hand chain operator and chain.
4. Size motor as recommended by door manufacturer, 208V, 3 phase.
5. Control motor by means of a recessed push button operator with 3 buttons and keyed lockout switching. Conceal all conduit in wall.
6. Provide removable safety cover over motor and mechanisms matching material and finish of hood.
7. **Motor Mounting:**
   a. Horizontal front hood.

2.5 LOCKING MECHANISM

A. Motorized Doors: Provide integral gearing locking mechanism to prevent opening of door except under normal operation methods.

2.6 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 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position for long life under hard use.

C. Upon completion of the installation, put all items through at least 10 operating cycles. Make required adjustments and assure that components are in optimum operating condition.

D. Labeled Doors: Install in strict accordance with NFPA 80.

E. Hoods: Do not mount hoods until all other work (including hanging curtains) in the area is completed. Replace damaged hoods.

3.3 DEMONSTRATION

A. Upon completion and prior to the acceptance of the work of this Section, schedule and conduct a meeting with the Owner and his personnel to train and thoroughly familiarize them with information necessary to operate and maintain the work. Include, but do not limit the training to:
   1. Operation and maintenance manuals;
   2. Safety procedures and requirements;
   3. Manufacturer's recommended cleaning procedures;
   4. Identification systems;
   5. System operation and features including, but not limited to:
      a. Start-up;
      b. Control sequences;
      c. Shut down;
      d. Controls manipulation;
      e. Emergency procedures;
      f. Noise/vibration adjustment;
   6. System maintenance.

B. Demonstration Meeting:
   1. Demonstrate each door through a minimum of 2 cycles.
   2. Prepare and execute In-Service Certification form and submit with closeout documentation.

END OF SECTION 08 3300

SECTION 08 5620 - PASS AND OBSERVATION WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide pass and observation windows, which are not specifically described in other Sections of these Specifications, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 08 1110: Hollow metal doors and frames
3. Section 08 8100: Glazing for pass windows.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer’s recommended installation procedures.
3. Shop Drawings: Submit details of each frame type, elevations of door designs, details of openings, and details of construction, installation, and anchorage.

1.3 EXTRA MATERIALS

A. Deliver specified keys to the Inspector of Record. Obtain and forward to the Architect, a signed receipt from the Inspector accepting delivery.

PART 2 - PRODUCTS

2.1 SLIDING SERVE WINDOWS

A. Acceptable Products: Self-Closing, Horizontal by-passing sliding window (one pane fixed, one operable), with sliding screen.
1. CRL SCDW Series Self-Closing Sliding Service Window by C.R. Laurence, (800) 421-6144.
2. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Maximum Force to Operate: 5 pounds; CBC 11B-309.4.

C. Materials:
1. Frames and Glass Channels: Heavy type 6063-T5 aluminum extrusions.
2. Screens: Standard black fiberglass.
3. Finish: Black anodized aluminum; matt black ceramic powder coat.
4. Glass: Provided under Section 08 8100. Type and color to match adjacent glass as shown on Door and Window Schedules and elevations.
5. Locks: Provide cylinder keyed locks. with 2 keys per opening, and 2 master keys.
6. Counter Seal: Provide wool pile counter seal typical.

D. Coordinate with hollow metal frames supplier for sized and tolerances required. Nominal sizes shown on drawings.

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 INSTALLATION

A. Placing Frames:
   1. Install frames and glass per manufacturer's recommendation.
   2. Attach to mullions by concealed screws through channel walls.

3.3 ADJUST AND CLEAN

A. Final Adjustments:
   1. Check and readjust operating finish hardware items to work just prior to final inspection.
   2. Leave work in complete and proper operating condition.
   3. Remove defective work and replace with work complying with the specified requirements.

END OF SECTION 08 5620

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following, but is not necessarily limited to:
1. Door hardware, including electric hardware.
2. Gate hardware.
3. Card reader access control devices.
4. Power supplies for electric hardware.
5. Thresholds, gasketing and weather-stripping.

C. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.
1. Division 08: Section - Hollow Metal Doors and Frames.
2. Division 08: Section - Flush Wood Doors.
3. Division 08: Section - Aluminum-Framed Storefronts.
4. Division 28: Section - Access Control and Fire/Life-Safety Systems

1.3 REFERENCES

A. 2022 California Building Code, CCR Title 24, Part 2

B. BHMA - Builders' Hardware Manufacturers Association

C. DHI - Door and Hardware Institute

D. NFPA - National Fire Protection Association.
1. NFPA 80 - Fire Doors and Other Opening Protectives
2. NFPA 105 - Smoke and Draft Control Door Assemblies

E. UL - Underwriters Laboratories.
1. UL 10C - Fire Tests of Door Assemblies
2. UL 305 - Panic Hardware

F. WHI - Warnock Hersey Incorporated

G. SDI - Steel Door Institute

1.4 SUBMITTALS & SUBSTITUTIONS

A. General: Submit in accordance with Conditions of the Contract and Division 01 Specification sections.

B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

C. Submit electronic PDF copies of schedule organized vertically into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:
1. Include a Cover Sheet with:
   a. Job Name, location, telephone number.
   b. Architects name, location and telephone number.
   c. Contractors name, location, telephone number and job number.
   d. Suppliers name, location, telephone number and job number.
   e. Hardware consultant's name, location and telephone number.
2. Job Index information included:
   a. Numerical door number index including; door number, hardware heading number and page number.
   b. Complete keying information (referred to DHI hand-book "Keying Systems and Nomenclature"). Provision should be made in the schedule to provide keying information when available; if it is not available at the time the preliminary schedule is submitted.
   c. Manufacturers' names and abbreviations for all materials.
   d. Explanation of abbreviations, symbols, and codes used in the schedule.
   e. Mounting locations for hardware.
   f. Clarification statements or questions.
   g. Catalog cuts and manufacturer’s technical data and instructions.
3. Vertical schedule format sample:

Heading Number 1 (Hardware group or set number - HW Group #1)				
(a) 1 Single - Door #101 - Corridor 101 to Exterior			(b) 90°	(c) RH
(d) 3'-0" x 7'-0" x 1-3/4" - Wood Door x Hollow Metal Frame - 20 Minute				
(e) 1.	(f) 3 ea	(g) Hinges - (h) 5BB1 4.5 x 4.5 NRP (i) 1/2 TMS	(j) 630	(k) IVE
2.	1 ea	Lockset - ND80P6D x RHO x RH x 10-025 x JTMS	626	SCH
3.	1 ea	Closer - 4040XP x EDA x TBSRT	689	LCN

(a) Single or pair of doors with opening number and location.
(b) Degree of opening.
(c) Hand of door(s).
(d) Door/frame dimensions and material; Label requirements, if any.
(e) Hardware item line # (Optional).
(f) Quantity.
(g) Product description.
(h) Product part number.
(i) Fastenings and other pertinent information.
(j) Hardware finish codes per ANSI/BHMA A156.18.
(k) Manufacturer abbreviation.

D. Make substitution requests in accordance with Division 01. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.

E. Keying Schedule: Submit separate detailed schedule indicating clearly how the District's final instructions on keying of locks has been fulfilled.

F. Wiring Diagrams: Provide product data and wiring and riser diagrams for all electrical products listed in the Hardware Schedule portion of this section.

G. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

H. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.

I. Fire Door Assembly Testing: Submit a written record of each fire door assembly to the District to be made available to the Authority Having Jurisdiction (AHJ) for future building inspections.

J. LEED Certification Points: Submit information and certifications necessary to achieve maximum points for LEED certification; coordinate and cooperate with Owner and Architect in providing information necessary for required LEED rating.

1.5 QUALITY ASSURANCE

A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that employs an experienced architectural hardware consultant (AHC) who is available to District, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
   1. Responsible for detailing, scheduling and ordering of finish hardware.
   2. Meet with District to finalize keying requirements and to obtain final instructions in writing.
   3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.

C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.

D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.
   1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".

E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

F. Product packaging to be labelled in compliance with CA Prop 65, Safe Drinking Water and Toxic Enforcement Act of 1986.

1.6 DELIVERY, STORAGE AND HANDLING

A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.

B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.

C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.

D. Contractor to inventory door hardware jointly with representatives of hardware supplier and hardware installer until each all are satisfied that count is correct.

1.7 WARRANTY

A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:
1. Locksets: Ten (10) years.
2. Exit devices: Ten (10) years.
3. Door Closers: Thirty (30) years.
4. Electronic: Three (3) years.
5. All other hardware: Two (2) years.

1.8 MAINTENANCE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for District's continued adjustment, maintenance, and removal and replacement of door hardware.

1.9 PRE-INSTALLATION CONFERENCE

A. Convene a pre-installation conference at least one week prior to beginning work of this section.

B. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, Key District's Personnel, and Project Inspector.

C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review District's keying standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Item	Manufacturer	Acceptable Substitutes
Hinges	Ives	Hager, Stanley, McKinney

Locks, Latches & Cylinders	Schlage	None – District Standard
Exit Devices	Von Duprin	None – District Standard
Door Closers	Norton	None – District Standard
Push, Pulls & Protection Plates	Ives	Trimco
Flush Bolts & Coordinators	Ives	Trimco
Door Stops	Ives	Trimco
Overhead Stops	Glynn-Johnson	Or Approved Equal
Seals, Bottoms & Thresholds	Zero	Pemko, NGP

2.2 MATERIALS

A. Hinges:
1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Hinges shall be sized in accordance with the following:
   a. Height:
      1) Doors up to 42" wide: 4-1/2 inches.
      2) Doors 43" to 48" wide: 5 inches.
   b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
   c. Number of Hinges: Provide 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.
3. Exterior out-swinging hinges shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.
4. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.

B. Continuous Hinges:
1. Provide aluminum geared continuous hinges fabricated from 6063-T6 aluminum conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
3. Provide continuous hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
4. Provide continuous hinges 1” shorter in length than nominal height of door, unless otherwise noted, with symmetrical hole pattern.
5. Install continuous hinges with fasteners supplied by manufacturer.

C. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Rhodes" lever design.
1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3 hour fire doors.
2. Provide cylindrical locksets exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security, and durability in the categories below:
   a. Abusive locked lever torque – minimum 3,100 inch-pounds without gaining access.
   b. Offset lever pull – minimum 1,600 foot pounds without gaining access.
   c. Vertical lever impact – minimum 100 impacts without gaining access.
   d. Cycle Test – tested to minimum 16 million cycles with no visible lever sag; without the use of performance aids such as set screws or spacers.
3. Cylinders: Refer to “KEYING” article, herein.
4. Provide locks with standard 2-3/4” backset, unless noted otherwise, with 1/2” latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide locksets with separate solid steel anti-rotation thru-bolts, and no exposed screws.
6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

9. Provide levers with vandal resistant technology as scheduled for use at abusive applications.
10. Indicators: Where specified, provide visual lock status indicators built-into lockset rose escutcheon.

D. Exit devices: Von Duprin as scheduled.
1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 standards.
3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Provide exit devices cut to door width and height. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
6. Provide flush end caps for exit devices.
7. Exit devices shall comply with CBC Section 11B-404.2.7 and shall be mounted between 34" and 44" above the finished floor surface.
8. Provide exit devices UL certified to meet 5 lbs. maximum unlatching force requirements according to the CBC Section 11B-309.4.
9. Cylinders: Refer to “KEYING” article, herein.
10. Provide cylinder dogging as specified at non fire-rated openings.
11. Removable Mullions: Provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
13. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
15. Provide exit devices with manufacturer’s approved strikes.
16. Provide electrified options as scheduled.
17. Panic hardware shall not be provided with “Night Latch” (NL) function for any accessible doors or gates unless the following conditions are met per DSA Interpretation 10-08 DSA/AC. Such conditions must be clearly demonstrated and indicated in the specification:
    a. Panic hardware contains a “dogging” feature and during the time the facility is open the panic hardware shall be “dogged”.
    b. The act of “dogging” a door in the open position shall only be performed by employees as a part of their job function (non-public use).

E. Door Closers:
1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Cylinder Body: 1-1/2” diameter with 5/8” diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120° F to -30° F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.

6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Provide door closers powder coated to match balance of door hardware. Powder coating finish shall be certified to exceed 100 hours salt spray testing as described in ANSI/BHMA A156.4 and ASTM B117.
9. Provide corrosion resistant model (SS) where noted in hardware sets.
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

F. Flush Bolts & Dust Proof Strikes:
1. Automatic flush bolts shall be of the low operating force design.
2. Provide top bolt only model for interior doors where applicable and as permitted by testing procedures.
3. Provide dust proof strikes at openings using bottom bolts.
4. Manual flush bolts shall only be permitted on storage or mechanical openings, as scheduled.

G. Door Stops:
1. Unless otherwise noted in hardware sets, provide floor or wall type with appropriate fasteners. Where neither floor or wall type can be used, provide overhead type.
2. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 11B-307).
3. Provide backing plate at wall framing behind wall type.
4. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions. Stop-only function shall be provided at fire-rated openings.

H. Protection Plates:
1. Provide kick, mop, and/or armor plates minimum of 0.050” thick, with four beveled edges. Furnish with sheet metal or wood screws, finished to match plates.
2. Kick plates shall be sized 10" high and 2" less door width (LDW) at single doors and 10” high and 1” LDW at pairs or doors.
3. Provide mop and armor plates with sizes as scheduled in hardware sets.

I. Thresholds: As scheduled and per details.
1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope. Thresholds shall comply with CBC Section 11B-404.2.5.
2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 07 “Thermal and Moisture Protection”.
3. Use 1/4” fasteners, red-head flat-head sleeve anchors (SS/FHSL).

J. Seals: Provide silicone gasket at all rated and exterior doors.
1. Smoke & Draft Control Doors: Provide UL10C Classified gasketing that complies with NFPA 80 & NFPA 252 for use on “S” labeled Positive Pressure door assemblies.

K. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where gasketing seals occur, or at fire-resistive-rated door assemblies.

2.3 KEYING

A. Furnish a proprietary Schlage masterkey system as directed by the District. Key system to be designated and combinated by the Schlage Master Key Department even if pinned by an Authorized Key Center, Authorized Security Center or a local authorized commercial dealer.

B. A detailed keying schedule is to be prepared by the District lock shop in consultation with a representative of Allegion or an Authorized Key Center or Authorized Security Center. Each keyed cylinder on every keyed lock is to be listed separately showing the door #, key group (in BHMA terminology), cylinder type, finish and location on the door.

C. Furnish all cylinders in the Schlage Full Size Interchangeable Core (FSIC) style. Pack change keys independently (PKI). Verify Schlage keyway with the District lock shop.

D. Furnish construction keying for doors requiring locking during construction.
1. Provide 23-030-ICX FSIC construction cores
2. Provide ten (10) 48-101-ICX cut keys for construction phase
3. Provide two (2) 48-056-ICX cut control keys for construction phase

E. Furnish all keys with visual key control (VKC).
1. Stamp key “Do Not Duplicate”.
2. Stamp (BHMA) key symbol on key.
3. Stamp unique owner identifier from the key bow.

F. Furnish mechanical keys as follows:
1. Furnish 2 cut change keys for each different change key code.
2. Furnish 1 uncut key blank for each change key code.
3. Furnish 6 cut masterkeys for each different masterkey set.
4. Furnish 3 uncut key blanks for each masterkey set.
5. Furnish 2 cut control keys cut to the top masterkey for permanent I/C cylinders.
6. Furnish 1 cut control key cut to each SKD combination.

G. Furnish Schlage Padlocks and the cylinders to tie them into the masterkey system for gates, storage boxes, utility valve security, roof hatches and roll-up doors keyed as directed in the keying schedule.
1. Furnish KS43F3200 padlock for use with Schlage FSIC cylinders. Furnish 23-030 (FSIC core) with padlock above.

H. Furnish one Schlage cabinet lock for each cabinet door or drawer so designated on the drawings or keying schedule to match the masterkey system.
1. Furnish CL777R for use with Schlage FSIC cylinders.

2.4 FINISHES

A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.

B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.

C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.

D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

2.5 FASTENERS

A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.

B. Screws for butt hinges shall be flathead, countersunk, full-thread type.

C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.

D. Provide expansion anchors for attaching hardware items to concrete or masonry.

E. All exposed fasteners shall have a phillips head.

F. Finish of exposed screws to match surface finish of hardware or other adjacent work.

G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.

B. Beginning of installation means acceptance of existing conditions.

C. Fire-Rated Door Assembly Inspection: Upon completion of the installation, all fire door assemblies shall be inspected to confirm proper operation of the closing device and latching device and that only the manufacturer's furnished fasteners are used for installation and that it meets all criteria of a fire door assembly per NFPA 80 (Standard for Fire Doors and Other Opening Protectives). A written record shall be maintained and transmitted to the Owner to be made available to the Authority Having Jurisdiction (AHJ). The inspection of the swinging fire doors shall be performed by a certified FDAI (Fire Door Assembly Inspector) with knowledge and understanding of the operating components of the type of door being subjected to the inspection. The record shall list each fire door assembly throughout the project and include each door number, an itemized list of hardware set components at each door opening, and each door location in the facility.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.

B. Use the templates provided by hardware item manufacturer.

C. Mounting heights for hardware shall be as recommended by DHI. Operating hardware shall be located between 34" and 44" above finish floor to comply with CBC Section 11B-404.2.7.

D. Door Closers:
1. Place door closers inside building, stairs, rooms, etc. Closers shall be installed to permit doors to swing 180 degrees or maximum allowable by conditions.

2. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors.
3. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs. when specifically approved by fire marshal.
4. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.
5. Compensating devices or automatic door operators may be utilized to meet the above standards.
6. Per CBC Section 11B-404.2.8.1, doors shall take minimum of 5 seconds to move from an open position of 90 degrees to 12 degrees to the latch jamb.

E. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

G. Set thresholds for exterior doors in full bed of butyl-rubber sealant.

H. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.

I. Electronic Hardware:
1. Hardware Installer shall coordinate with security contractor to route cable to connect electrified locks, panic hardware and fire exit hardware to power transfers or electric hinges at the time these items are installed so as to avoid disassembly and reinstallation of hardware.
2. Hardware Installer shall also be present with the security contractor when the power is turned on for the testing of the electronic hardware applications. Installer shall make adjustments to solenoids, latches, vertical rods and closers to insure proper and secure operation.
3. All wiring for electro-mechanical hardware mounted on the door shall be connected through the power transfer and terminated in the interface junction box specified for in the Electrical Section.
4. Conductors shall be minimum 18 gage stranded, multicolored. A minimum 12 in. loop of conductors shall be coiled in the interface junction box. Each conductor shall be permanently marked with its function.
5. If a power supply is specified in the hardware sets, all conductors shall be terminated in the power supply. Make all connections required for proper operation between the power supply and the electro-mechanical hardware. Provide the proper size conductors as specified in the manufacturer’s technical documentation.

3.3 ADJUST AND CLEAN

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

B. Clean adjacent surface soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper

function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct District's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct District's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE LOCATIONS

A. Conform to CCR, Title 24, Part 2; and ADA Standards; and the drawings for access-compliant positioning requirements for the disabled.

3.5 FIELD QUALITY CONTROL

A. Contractor is responsible for providing the services of an Architectural Hardware Consultant (AHC) or a proprietary product technician to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturers' instructions and as specified herein.

3.6 HARDWARE SCHEDULE

A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.

B. While the hardware schedule is intended to cover all doors, and other movable parts of the building, and establish type and standard of quality, the contractor is responsible for examining the Plans and Specifications and furnishing proper hardware for all openings whether listed or not. If there are any omissions in hardware groups in regard to regular doors they shall be called to the attention of the Architect prior to bid opening for instruction; otherwise, list will be considered Complete. No extras will be allowed for omissions.

C. The Door Schedule on the Drawings indicates which hardware set is used with each door.

MANUFACTURERS ABBREVIATIONS

GLY	=	Glynn-Johnson	Overhead Stops
IVE	=	Ives	Hinges, Vandal Door Pulls, Flush Bolts, Door Stops, Kick Plates & Silencers
JOH	=	Johnson Hardware	Sliding Door Hardware
KEE	=	Keedex	Gate Lock Boxes
LOC	=	Locinox	Gate Closers
NOR	=	Norton	Door Closers
SCH	=	Schlage Lock	Locks, Latches & Cylinders
SCE	=	Schlage Electronics	Electronic Door Components
TRM	=	Trimco	Lock Guards
VON	=	Von Duprin	Exit Devices
ZER	=	Zero International	Gasketing, Door Bottoms & Thresholds

HW GROUP NO. 01

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QELX-PA-AX-99-NL-OP	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	VANDAL RESISTANT PULL	VR910 NL	630	IVE
1	EA	SURFACE CLOSER	PR7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18S	BLK	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER
1	EA	REMOTE DESK BUTTON	660-PB	628	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		SCE
		CARD READER/INTERCOM	BY WORK OF DIVISION 28		

HW GROUP NO. 02

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CD-PA-AX-99-NL-OP	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	VANDAL RESISTANT PULL	VR910 NL	630	IVE
1	EA	SURFACE CLOSER	PR7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW GROUP NO. 03

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CD-PA-AX-99-NL-OP	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	VANDAL RESISTANT PULL	VR910 NL	630	IVE
1	EA	OH STOP & HOLDER	100H ADJ	630	GLY
1	EA	SURFACE CLOSER	PR7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW GROUP NO. 04

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224XY EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954 X 154	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QELX-PA-AX-99-NL-OP	626	VON
1	EA	ELEC PANIC HARDWARE	LD-RX-PA-AX-99-EO	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	PR7500	689	NOR
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC		SCE
		CARD READER/INTERCOM	BY WORK OF DIVISION 28		

HW GROUP NO. 05

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224XY	628	IVE
1	EA	REMOVABLE MULLION	KR4954 X 154	689	VON
1	EA	PANIC HARDWARE	CD-PA-AX-99-NL-OP	626	VON
1	EA	PANIC HARDWARE	LD-PA-AX-99-EO	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
3	EA	FSIC CORE	23-030	626	SCH
2	EA	SURFACE CLOSER	PR7500	689	NOR
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW GROUP NO. 06

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	LOCK GUARD	1082-6	630	TRM
1	EA	SURFACE CLOSER	PR7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW GROUP NO. 07

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	LOCK GUARD	1082-6	630	TRM
1	EA	SURFACE CLOSER	CPS7500 H	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW GROUP NO. 08

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	LOCK GUARD	1082-6	630	TRM
1	EA	SURFACE CLOSER	CPS7500 H	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW GROUP NO. 09

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	VANDL CLASSROOM LOCK	ND94TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	LOCK GUARD	1082-6	630	TRM
1	EA	OH STOP & HOLDER	100H ADJ	630	GLY
1	EA	SURFACE CLOSER	PR7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW GROUP NO. 10

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FACULTY RESTROOM LOCK W/ INDICATOR	LV9485T 06A L583-363 OS-OCC	626	SCH
1	EA	FSIC CORE	30-120	626	SCH
1	EA	SURFACE CLOSER	CPS7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW GROUP NO. 11

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	PR7500 (ON ACTIVE LEAF ONLY)	689	NOR
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	ASTRAGAL	43SP	SP	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW GROUP NO. 12

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2	626	IVE
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	PR7500 (ON ACTIVE LEAF ONLY)	689	NOR
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FLOOR STOP/HOLDER	FS43	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	ASTRAGAL	43SP	SP	ZER
1	EA	THRESHOLD	PER SILL DETAIL	A	ZER

HW GROUP NO. 13

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	CD-PA-AX-99-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	PR7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP/HOLDER	WS45	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 14

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	ND78JD RHO 47342586	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP/HOLDER	WS45	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 15

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70JD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP/HOLDER	WS45	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO. 16

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FACULTY RESTROOM LOCK	ND85P6D RHO	626	SCH
1	EA	SURFACE CLOSER	7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 17

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CORRIDOR LOCK W/ IND	ND73JD RHO OS-OCC	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 18

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	DBL CYL STORE LOCK	ND66JD RHO	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 19

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50JD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 20

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50JD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	OVERHEAD STOP	90S	689	GLY
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 21

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ IND	ND40S RHO OS-OCC	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. 22

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO. 23

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CONST LATCHING BOLT	FB51T	630	IVE
1	EA	STOREROOM LOCK	ND80JD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	PR7500 (ON ACTIVE LEAF ONLY)	689	NOR
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP/HOLDER	WS45	626	IVE
1	EA	ASTRAGAL	44STST OR BY HM DOOR MFR	STST	ZER
2	EA	SILENCER	SR64	GRY	IVE

HW GROUP NO. 24

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	224XY	628	IVE
1	EA	REMOVABLE MULLION	KR4954 X 154	689	VON
1	EA	PANIC HARDWARE	CD-OUT-PA-AX-99-NL-OP-WH	626	VON
1	EA	PANIC HARDWARE	LD-OUT-PA-AX-99-EO-WH	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
3	EA	FSIC CORE	23-030	626	SCH
1	EA	VANDAL RESISTANT PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	P7500 SS	689	NOR
2	EA	FLOOR STOP	FS18L	BLK	IVE

HW GROUP NO. 25

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PANIC HARDWARE	CD-OUT-PA-AX-99-NL-OP-WH	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	VANDAL RESISTANT PULL	VR910 NL	630	IVE
1	EA	SURFACE CLOSER	P7500 SS	689	NOR
1	EA	FLOOR STOP	FS18L	BLK	IVE

HW GROUP NO. 26

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	SLIDING DOOR HARDWARE	200WF SERIES W/SOFT-CLOSE	AL	JOH
1	EA	BTB DOOR PULL	PR 8103EZHD 10" N	630-316	IVE

HW GROUP NO. 27 - HARDWARE BY ROLL-UP DOOR MANUFACTURER

HW GROUP NO. 28

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	PA-AX-99-L-NL-06	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	PR7500	689	NOR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW GROUP NO. G01

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	GATE CLOSER & HINGE	LOCINOX MAMMOTH-180	AL	LOC
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	WELDABLE GATE BOX	K-BXRHO		KEE

HW GROUP NO. G02

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	GATE CLOSER & HINGE	LOCINOX MAMMOTH-180	AL	LOC
1	EA	PANIC HARDWARE	CD-OUT-PA-AX-99-L-NL-06-WH	626	VON
1	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	26-091 ICX XQ11-948	626	SCH
2	EA	FSIC CORE	23-030	626	SCH

HW GROUP NO. G03

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	GATE CLOSER & HINGE	LOCINOX MAMMOTH-180	AL	LOC
1	EA	VANDL STOREROOM LOCK	ND96TD RHO	626	SCH
1	EA	FSIC CORE	23-030	626	SCH
1	EA	WELDABLE GATE BOX	K-BXRHO		KEE

HW GROUP NO. G04

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	FSIC PADLOCK	KS43F3200	606	SCH
1	EA	FSIC CORE	23-030	606	SCH
			BALANCE OF HARDWARE BY GATE FABRICATOR		

HW GROUP NO. G05 - HARDWARE BY ROLLING GATE MANUFACTURER

GATE G20 TO BE CONNECTED TO VERKADA ACCESS CONTROL SYSTEM. COORDINATE ELECTRONIC UNLOCKING REQUIREMENTS WITH DIVISION 28 AND GATE MANUFACTURER.

HW GROUP NO. G06

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	GATE CLOSER & HINGE	LOCINOX MAMMOTH-180	AL	LOC
1	EA	VANDL CLASSROOM SECURITY	ND98TD RHO	626	SCH
2	EA	FSIC CORE	23-030	626	SCH
1	EA	WELDABLE GATE BOX	K-BXRHO		KEE

HW GROUP NO. G07

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	ELECTRIC CYLINDER LOCK	BEST 1W7B2 (KEYWAY AS REQ BY FIRE DEPARTMENT) BALANCE OF HARDWARE BY ROLLING GATE MANUFACTURER	626	BES

PROVIDE BATTERY BACK-UP AT ELECTRIC GATES PER CFC SECTION 503.6.

GATE G8 TO BE CONNECTED TO VERKADA ACCESS CONTROL SYSTEM. COORDINATE ELECTRONIC UNLOCKING REQUIREMENTS WITH DIVISION 28 AND GATE MANUFACTURER.

HW GROUP NO. G08

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	BY GATE FABRICATOR		
1	EA	DBL CYL DEADBOLT	B662T	626	SCH
1	EA	FSIC PADLOCK	KS43F3200	606	SCH
3	EA	FSIC CORE	23-030	626	SCH
1	EA	WELDABLE GATE BOX	K-BXSGL		KEE
1	EA	LOCKABLE DROP ROD	BY GATE FABRICATOR		

END OF SECTION

SECTION 08 8100 - GLASS GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide glazing and glazing accessories where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 06 4200: Glazing for casework.
3. Section 07 9210: Sealants and caulking.
4. Section 08 1110: Glazing for vision panels in metal doors and frames is specified in this Section.
5. Section 08 1400: Glazing for vision panels in wood doors is specified in this Section.
6. Section 08 5620: Glazing for pass and observation windows is specified in this Section.
7. Section 09 9100: Field painting of metal panels.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation.
3. Samples: Submit 2 samples, 4" x 4" in size, of each type of glass and gasket proposed for use.

B. Contract Closeout Submittals: Comply with requirements of Section 01 7700.
1. Manufacturer's recommended cleaning procedures for each type of glazing panel.

1.3 QUALITY ASSURANCE

A. In addition to complying with pertinent codes and regulations of governmental agencies having jurisdiction, comply with pertinent recommendations contained in:
1. Flat Glass Marketing Association:
a. "Glazing Sealing Systems Manual";
b. "Glazing Manual".

B. Identification of Safety Glazing:
1. Identify each light of safety glass material installed in hazardous locations as defined in CBC 2406.3 by a label that complies with CBC 2403.1 and which will specify the labeler, whether manufacturer or installer, and state that safety glazing material has been utilized in such installations.
2. The label shall be legible and visible from the inside of the building after installation and shall be acid etched, sand blasted, ceramic fired laser etched, or embossed.

C. Provide tinted or coated glazing panels by one and the same manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 6600.

B. During storage and handling of glass, provide cushions at edges to prevent impact damage.

1.5 SPECIAL WARRANTY

A. In addition to the warranty requirements of the Contract Documents, submit 2 original copies of glazing manufacturer's written warranty, countersigned by the glazing subcontractor and the Contractor, covering warranties listed below and including removal of the failed or deteriorated glazing, furnishing the matching replacement glazing, and properly installing the matching replacement glazing.
   1. Coated Single Pane Glass: Warranty glass for **10 years** against coating deterioration.
   2. Sealed Insulating Glass Units: Warranty units for **5 years** against seal failure, interpane dusting or misting.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 GLASS

A. General:
   1. For all glass, provide the type and thickness shown on the Drawings or specified herein.
   2. Where type or thickness, or both, are not shown on the Drawings or specified herein, provide type and thickness directed by the Architect.

B. Primary Glass:
   1. Provide primary glass complying with ASTM C1036.
   2. Clear Float Glass: Type I, class 1 (transparent), quality q3 (glazing select).
   3. Tinted Float Glass: Type I, class 2 (heat absorbing and light reducing), quality q3 (glazing select), of tint as indicated or specified.

C. Tempered Glass: Grade B (fully tempered), style I (uncoated surfaces), type I (float), class 1 (transparent), quality q3 (glazing select). All tempered glass is to be safety glass and meet human impact loads indicated below.
   1. Tints: Tints as indicated or specified.
   2. Sizes and Cutting:
      a. Prior to tempering, cut glass to required sizes as determined by accurate measurements of the openings to be glazed, making allowances for required edge clearances.
      b. Cut and process edges in accordance with the glass manufacturer's recommendations.
      c. Do not cut or treat edges in the field.

D. Human Impact Loads: Individual glazed areas, including glass mirrors, in hazardous locations as defined by CBC Section 2406.4 shall comply with CBC Sections 2406.1 through 2406.5.

E. Global Warming Potential: Flat glass material shall comply with CA Green Building Standards Code Table 5.409.3 and have a maximum acceptable GWP of 2.50 kg CO_2e/MT.

2.3 OTHER MATERIALS

A. Provide other materials, including but not limited to shims, setting blocks, glazing tape, etc., not specifically described but required for a complete and proper installation, as recommended by the manufacturer.

2.4 EXTERIOR GLAZING ASSEMBLIES

A. Air and Vapor Seals: Provide completed assemblies that maintain continuity of building enclosure air barrier:
1. In conjunction with joint sealer materials described in other sections.
2. To utilize the inner pane of multiple pane sealed units for the continuity of the air barrier seal.
3. To maintain a continuous air barrier throughout the glazed assembly from glass pane to heel bead of glazing sealant.

2.5 GLAZING PANEL TYPES

A. **Type A:** 1/4" thick, clear, fully tempered glass.

B. **Type B:** 1/4" thick, tinted, fully tempered glass, PPG Graylite II.
1. U Factor: 1.02 minimum.
2. Solar Heat Gain Coefficient: 0.35 maximum.

B1. **Type B1:** 1/4" thick, clear, fully tempered glass. Apply 3M Automotive Window Film Color Stable Series tint, visible light transmittance 30%. Review Test Samples with Owner.

F. **Type F:** 1" thick tinted insulating glass unit; fully tempered.
1. Outdoor Lite: 1/4" fully tempered glass with Graylite II tint with PPG Solarban 60 Low-E coating inside facing surface.
2. Air Space: 1/2" air space filled with gas (90% Argon, 10% air).
3. Indoor Lite: 1/4" clear fully tempered glass.
4. NFRC U-Value: 0.24 BTU/hr ft^2 ^oF (winter nighttime).
5. Solar Heat Gain Coefficient: 0.13.
6. Light to Solar Gain: 0.46.
7. Durability: Certified by an independent testing agency to comply with ASTM E2190.
8. Edge Spacers: Aluminum, bent and soldered corners; color as selected by Architect.
9. Edge Seal: Glass to elastomer with supplementary silicone sealant.
10. Purge interpane space with dry hermetic air.

G. **Type G:** 1" thick clear insulating glass unit; fully tempered.
1. Outdoor Lite: 1/4" fully tempered clear glass with PPG Solarban 60 Low-E coating inside facing surface.
2. Air Space: 1/2" air space filled with gas (90% Argon, 10% air).
3. Indoor Lite: 1/4" clear fully tempered glass.
4. NFRC U-Value: 0.24 BTU/hr ft^2 ^oF (winter nighttime).
5. Solar Heat Gain Coefficient: 0.39 maximum.
6. Light to Solar Gain: 1.79.
7. Durability: Certified by an independent testing agency to comply with ASTM E2190.
8. Edge Spacers: Aluminum, bent and soldered corners; color as selected by Architect.
9. Edge Seal: Glass to elastomer with supplementary silicone sealant.
10. Purge interpane space with dry hermetic air.

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.

B. Clean glazing channels, stops, and rabbets to receive the glazing materials, making free from obstructions and deleterious substances which might impair the work.
   1. Remove protective coatings which might fail in adhesion or interfere with bond of sealants.
   2. Comply with manufacturers' instructions for final wiping of surfaces immediately prior to application of primer and glazing compounds or tapes.
   3. Prime surfaces to receive glazing compounds in accordance with manufacturers' recommendations.

3.2 INSTALLATION

A. Inspect each piece of glass immediately prior to start of installation.
   1. Do not install items which are improperly sized, have damaged edges, or are scratched, abraded, or damaged in any other manner.
   2. Do not remove labels from glass until so directed by the Architect.
   3. Install glass so distortion waves, if present, run in the horizontal direction.

B. Locate setting blocks at sills one quarter of the width of the glass in from each end of the glass, unless otherwise recommended by the glass manufacturer.
   1. Use blocks of proper size to support the glass in accordance with the manufacturer's recommendations.
   2. Provide spacers for all glass sizes larger than 50 united inches, to separate glass from stops; except where continuous glazing gaskets or felts are provided.
      a. Locate spacers no more than 24" apart, and no closer than 12" to a corner.
      b. Place spacers opposite one another.
      c. Make bite of spacer on glass 1/4" or more.

C. Set glass in a manner which produces the greatest possible degree of uniformity in appearance.

D. Do not use two different glazing materials in the same joint system unless the joint use is approved by the Architect.

E. Mask, or otherwise protect, surfaces adjacent to installation of sealants. Provide black continuous caulking sealant bead at all glass to metal frame joints, over exposed edge of tape, interior and exterior.

F. Miter-cut and seal the joints of glazing gaskets in accordance with the manufacturer's recommendations, to provide watertight and airtight seal at corners and other locations where joints are required.

3.3 PROTECTION

A. Protect glass from breakage after installation by promptly installing streamers or ribbons, suitably attached to the framing and held free from glass. Do not apply warning markings, streamers, ribbons, or other items directly to the glass except as specifically directed by the Architect.

3.4 CLEAN-UP

A. Clean glass thoroughly prior to final acceptance. Take special care not to remove materials which may scratch glass. **Scratched glass will be rejected and replaced prior to acceptance.**

END OF SECTION 08 8100

SECTION 08 9100 - LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide the work of this Section as indicated on the drawings and as specified.

B. Related Sections:
1. Documents affecting the Work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 06 1100: Carpentry
3. Section 07 9210: Perimeter sealant joints.
4. Section 08 1110: Louvers in metal doors.
5. Division 23 0000: Air-handling louvers connected to ductwork.
6. Division 23 0000: Blankoff panels or plates for air-handling louvers.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.
3. Shop Drawings: Submit shop drawings for fabrication and erection of louver units and accessories. Include plans, elevations, and details of sections and connections to adjoining work. Indicate materials, finishes, fasteners, joinery, and other information to determine compliance with specified requirements.

1.3 QUALITY ASSURANCE

A. Performance Requirements: Where louvers are indicated to comply with specific performance requirements, provide units whose performance ratings have been determined in compliance with Air Movement and Control Association (AMCA) Standard 500.
1. Provide louvers with AMCA Certified Ratings Seal evidencing that product complies with the above requirement.

B. SMACNA: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details and installation procedures, except as otherwise indicated.

C. Field Measurements: Verify size, location and placement of louver units prior to fabrication.

1.4 SPECIAL WARRANTY

A. PVDF (Polyvinylidene Fluoride) Coating Warranty: In addition to the warranty requirements of the Contract Documents, submit 2 original copies of coating applicator's 5-Year warranty. Warrant coating against peeling, blistering, flaking, chipping, checking, chalking in excess of a numerical rating of 8 when measured in accordance with ASTM D659, and fading and color change in excess of 5 NBS units when measured in accordance with ASTM D2244.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Subject to compliance with requirements, provide products of 1 of the following:
1. Airline Products Co.
2. The Airolite Co.
3. American Warming and Ventilating Co.
4. Construction Specialties, Inc.
5. Industrial Louvers, Inc.
6. Ruskin Manufacturing Co.
7. Louvers and Dampers, Inc.
8. Architectural Louvers.
9. Safe-air/Dowco.

2.2 HORIZONTAL BLADE LOUVERS

A. Provide louvers of size and depth indicated, with blades of profile, slope and spacing indicated, or if not indicated, to meet performance requirements.

B. Material: Aluminum extrusions, ASTM B2221, alloy 6063-T52.

C. Extrusion Thickness: Not less than 0.081" for blades and frames.

D. Factory Finish PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; 70% KYNAR 500 resin or HYLAR 5000 resin, 1.0 mil minimum dry film thickness.

E. Furnish units complying with following performance requirements:
1. Free area: Not less than 45% on a 48" x 48" sized louver.
2. Static pressure loss: Not more than 0.15" of water gage at an airflow of 1000 fpm free air velocity.
3. Water penetration: Not more than 0.05 oz. per sq. ft. of free area at an intake airflow of 100 fpm free area velocity.
4. AMCA ceritification: Furnish units bearing AMCA Certified Ratings seal.

F. Horizontal Drainable Blades: Units designed to collect and drain water to exterior at sill by means of gutters in front edges of blades, and channels in jambs and mullions.

G. Continuous Horizontal Blades: Conceal supporting framework from vision on outside face of louver by placing braces, mullions, and brackets on inside face; with close fitting, field-made splice joints in blades designed to permit expansion and contraction without deforming blades or framework.
1. Exterior corners: Shop miter and weld blades into prefabricated corner units to align with straight sections. Include corner bracing.

H. Continuous Vertical Assemblies: Where height of louver sections exceed fabrication and handling limitations, fabricate units to permit field-bolted assembly with blade pattern uninterrupted in vertical spacing, or by horizontal mullions at joints between superimposed sections; with close fitting joints in jamb frames, reinforced with splice plates.

2.3 LOUVER SCREENS

A. Provide removable bird screens for exterior louvers of 1/2" mesh, 0.063" aluminum wire.

B. Fabricate screen frames of same metal and finish as louver units to which secured. Provide frames consisting of U-shaped metal for permanently securing screen mesh.

C. Locate screens on inside face of louvers. Secure screens to louver frames with machine screws spaced at each corner and at 12" on center between.

2.4 FASTENERS

A. Provide stainless steel or aluminum screws of types, gages, and lengths to suit installation conditions. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

2.5 FABRICATION

A. Fabricate frames including integral sills to suit adjacent construction with tolerances for installation, including application of sealants in joints between louvers and adjoining work.

B. Provide supports, anchorages, and accessories required for complete assembly.

C. Provide vertical mullions of type and at spacing indicated but no further apart than recommended by manufacturer or 72" on center, whichever is less. At horizontal joints between louver units provide horizontal mullions except where continuous vertical assemblies are indicated.

D. Provide sill extensions and loose sills made of same material as louvers, where indicated, or required for drainage to exterior and to prevent water penetrating to interior.

E. Join frame members to one another and to louver blades by welding except where field bolted connections between frame members are made necessary by size of louvers. Maintain equal blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place louver units plumb, level, and in proper alignment with adjacent work.

B. Use concealed fasteners wherever possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make weathertight connection.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers.

D. Protect galvanized and aluminum surfaces against corrosion and galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry, or dissimilar metal.

END OF SECTION 08 9100

SECTION 09 0560 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide floor preparation and moisture testing as specified herein and as needed for a complete and proper flooring installation. This section applies to all floors identified in the contract documents as to receive the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Carpet tile.

B. This Section includes:
   1. Preparation of new and existing concrete floor slabs for installation of floor coverings.
   2. Testing of concrete floor slabs for moisture and pH.

C. The Owner's independent testing shall conduct the following tests:
   1. Vapor Emissions Testing.
   2. Relative Humidity Testing.
   3. Ph (Alkalinity) Testing.

D. Related Sections:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. Section 01 2100: Cash allowances.
   3. Section 03 3300: Cast-in-place concrete floor slabs.
   4. Section 09 6110: Moisture control treatment for flooring (cash allowance).
   5. Section 09 6500: Resilient flooring.
   6. Section 09 6710: Epoxy marble chip flooring.
   7. Section 09 6800: Carpeting.

1.3 CASH ALLOWANCE

A. Refer to Section 01 2100 for cash allowance requirements related to moisture control for flooring.

1.4 REFERENCES

A. All work shall be performed in accordance with the Drawings and Specifications, and with the following standards:
   1. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens); 2008.
   2. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2008.
   3. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2010.
   4. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2009.
   5. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; May 2011.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.6 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and pH limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

C. Testing Agency's Report: Include:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and pH test reports.
   4. Copies of specified test methods.
   5. Recommendations for remediation of unsatisfactory surfaces.
   6. Submit report to Architect.
   7. Submit report not more than two business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

E. Copy of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings.

1.7 QUALITY ASSURANCE

A. Moisture and pH testing will be performed by an independent testing agency employed and paid by Owner.

B. Contractor may perform adhesive and bond test with his own personnel or hire a testing agency.

C. Contractor's Responsibility Relating to Independent Agency Testing:
   1. Provide access for and cooperate with testing agency.
   2. Confirm date of start of testing at least 10 days prior to actual start.
   3. Allow at least 4 business days on site for testing agency activities.
   4. Achieve and maintain specified ambient conditions.
   5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:

1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

PART 3 - EXECUTION

3.1 ORDER OF OPERATIONS

A. Perform following operations in the order indicated:
1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
   a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
   b. Removal of existing floor covering.
2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
   a. Do not attempt to remove coating or penetrating material.
   b. Do not abrade surface.
3. Preliminary cleaning.
4. Moisture vapor emission tests.
5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated..
6. pH tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
7. Specified remediation, if required.
8. Patching, smoothing, and leveling, as required.
9. Other preparation specified.
10. Adhesive bond and compatibility test.
11. Protection.

B. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating over entire suspect floor area.
3. Excessive pH: If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.2 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.3 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows:
   1. Place 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.4 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.5 pH TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements. This procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
   1. Use a wide range pH paper, its associated chart, and distilled or deionized water.
   2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the pH paper into the water, remove it, and compare immediately to chart to determine pH reading.
   3. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value is over 10.

3.6 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Concrete Subfloors:

1. Verify that substrate is smooth, level, at required finish elevation, and without more than 1/8" in 10'-0" variation from level or slopes shown on the Drawings.
2. Clean cracks, control joints, and other non-moving joints.
3. Broom clean or vacuum the surfaces to be covered, and inspect the subfloors.
3. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
4. Seal patching compound with sealer recommended by the manufacturer and compatible with the flooring products specified.
5. Do not fill expansion joints, isolation joints, or other moving joints.
6. Prohibit traffic until patching compound is cured and sealed.

3.7 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.8 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION 09 0560

SECTION 09 2115 - SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide gypsum board shaft wall assemblies and accessories where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 09 2220: Gypsum board metal suspension systems.
3. Section 09 2900: Gypsum wallboard systems.
4. Section 09 9100: Painting.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit 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.

1.3 QUALITY ASSURANCE

A. Rated Construction: Comply with the requirements of the indicated system design number and/or test number to furnish the required rating for:
1. Fire-rated construction

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 GYPSUM WALLBOARD

A. Face Board: In widths and lengths as will result in a minimum of joints, while complying with required codes and regulations.
1. Fire-Resistant Gypsum Wallboard: ASTM C36, Type X, 5/8" thick.
2. Water-Resistant and Fire-Resistant Gypsum Wallboard: ASTM C630, Type X, 5/8" thick.

B. Liner Board: ASTM C1396, 1" thick, 24" wide, in lengths as will result in a minimum of joints, while complying with required codes and regulations.

2.3 SHAFT WALL STUD SYSTEM

A. ASTM C645, roll-formed steel shaft wall studs, runners, and tracks, galvanized ASTM A525 G60, 20 gage minimum.

2.4 METAL TRIM

A. Refer to Section Section 09 2900 - Gypsum Board.

2.5 FASTENING DEVICES

A. Flat-head screws, shouldered, specially designed for use with power-driven tools, not less than 1" long, with self-tapping threads and self-drilling points.

2.6 JOINTING SYSTEM

A. Refer to Section Section 09 2900 - Gypsum Board.

2.7 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 SHAFT WALL STUD SYSTEM

A. Install and align accurately according to the layout indicated and continue from floor to structure above with splicing.

B. Securely attach to floor and structure above with proper fasteners at each end and at a maximum spacing of 24" on center.

C. Position studs vertically in runners and attach to runners by positive screw engagement through each stud flange and runner flange on both sides of wall.

D. Locate studs at wall openings and at wall intersections in accordance with the manufacturer's written instructions.

E. Where metal stud system is to be attached to steel that is to be spray fireproofed, install metal stud system prior to spray fireproofing and remove fireproofing from metal stud system before installing wall board.

3.3 LINER PANEL INSTALLATION

A. Install liner panels between vertical studs in accordance with the manufacturer's written recommendations. Where shaft wall exceeds maximum available panel height, position liner panel end joints within upper and lower third points of wall. Stagger joints top and bottom in adjacent panels.

3.4 FACE PANEL INSTALLATION

A. General:
   1. Install the gypsum wallboard in accordance with the Drawings and with the separate boards in moderate contact but not forced in place.
   2. At internal and external corners, conceal the cut edges of the boards by the overlapping covered edges of the abutting boards.
   3. Stagger the boards so that corners of any four boards will not meet at a common point except in vertical corners.

B. Walls:
   1. Install the gypsum wallboard to studs at right angles to the furring or framing members.
   2. Make end joints, where required, over framing, furring members, or solid backing.

3.5 JOINT TREATMENT AND FINISHING

A. Provide joint and edge treatment, finishing and texturing in accordance with Section 09 2900 - Gypsum Board.

END OF SECTION 09 2115

SECTION 09 2220 - GYPSUM BOARD METAL SUSPENSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide metal suspension systems for gypsum board ceilings where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 09 2900: Gypsum board.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.

PART 2 - PRODUCTS

2.1 SUSPENSION SYSTEM COMPONENTS

A. System Components:
1. Material: Cold-formed sheet steel, 33,000 psi minimum yield strength; ASTM C645 and C754.
2. Finish: Zinc-coated; ASTM A653-G40 minimum.

B. Main Runner Channels: C-shaped, 1-1/2" high, 1/2" flange width, 0.414 lb/ft minimum, 16 gage (0.0566 in.) minimum steel thickness.

C. Furring Channels: Hat-shaped with 2 equal legs and flanges, 7/8" or 1-1/2" high as indicated on the drawings, 20 gage (0.0296 in.) minimum steel thickness.

D. Resilient Channels: Single-leg type with screw flange, punched leg, and top flange, 1/2" high, 24 gage (0.0179 in.) minimum steel thickness.

E. Wire: Galvanized soft-annealed steel wire; ASTM A641.
1. Hanger Wires: 8 gage (0.1620 in.) minimum steel thickness.
2. Bracing Wires: 12 gage (0.1055 in.) minimum steel thickness.
2. Tie Wires: 16 gage (0.0625 in.) minimum steel thickness.

2.2 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.

3.3 MAIN RUNNER CHANNELS

A. Space runner channels at 3'-0" on center, level; saddle tie hanger wires around main runner channels to develop full strength of hanger.

B. Provide channels within 6" of abutting walls.

C. Splice channels by lapping and interlocking 12" minimum and tie each end with double loops of 16 gage tie wire.

D. At recessed fixtures and other openings that interrupt the ceiling, install additional cross reinforcing to maintain structural integrity of framing.

3.4 SHEET METAL FURRING CHANNELS

A. Space furring channels at 16" on center and securely saddle tie to main runners as indicated on the drawings.

B. Splice furring channels by lapping and interlocking 8" minimum and tie each end with double loops of 16 gage tie wire.

3.2 HANGER AND BRACING WIRE INSTALLATION

A. Hanger Wires: Install hanger wires at 4'-0" on center spacing along main runners. Splices will not be permitted in any hanger wires.
   1. Provide hanger wires at the ends of all main runners within 8" from the support and within 1/4 of the length of the end runner, whichever is least, for the perimeter of the ceiling area.
   2. Provide trapeze or other supplementary support members at obstructions to main hanger spacing. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits or discontinuous areas. Hanger wires that are more than 1 in 6 out of plumb are to have counter-sloping wires.
   3. At the perimeter of the ceiling area where main or cross runners are not connected to the adjacent wall, provide interconnection between the runners at the free end to prevent lateral spreading. A metal strut or a 16 gage wire with a positive mechanical connection to the runner may be used.

B. Bracing Wires: Provide sets of four 12 gage splayed bracing wires oriented 90 degrees from each other at the following spacing:
   1. Place sets of bracing wires at a spacing not more than 12 feet by 12 feet on center.
   2. Provide bracing wires at locations not more than 1/2 the spacings given from each perimeter wall and at the edge of vertical ceiling offsets.
   3. A strut fastened to the main runner at the convergence of the splayed wires shall be extended to and be fastened to the roof or floor structural members above or to such other framing deemed acceptable to the enforcement agency. These horizontal restraint points shall be placed not more than 12 feet by 12 feet on centers. There shall be a restraint point a distance of not more than one half of the above spacing from each surrounding wall.
   4. The slope of the splayed bracing wires shall not exceed 45 degrees from the plane of the ceiling and shall be taut without causing the ceiling to lift. Splices in bracing wires shall not to be permitted.

C. General:
   1. Fasten hanger wires with not less than 3 tight turns. Fasten bracing wires with 4 tight turns. Make all tight turns within a distance of 1-1/2 inches. Hanger or bracing wire anchors to the structure should be installed in such a manner that the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire.
   2. Separate all ceiling hanging and bracing wires at least 6 inches from all unbraced ducts, pipes, conduit, etc. It is acceptable to attach lightweight items, such as single electrical conduit not exceeding 3/4 inches nominal diameter, to hanger wires using connectors acceptable to DSA/SSS.

D. Field Testing:
   1. When drilled-in concrete anchors or shot-in anchors are used in reinforced concrete for **hanger wires**, **1 out of 10 must be field tested for 200 pounds of tension.**
   2. When drilled-in concrete anchors are used for **bracing wires**, **1 out of 2 must be field tested for 440 pounds in tension.** Shot-in anchors in concrete are not permitted for bracing wires. If any shot-in or drilled-in anchor fails, all adjacent anchors must be tested.
      a. Drilled-in or shot-in anchors require special DSA/SSS approval when used in prestressed concrete.
   3. Attach all light fixtures to the ceiling suspension system to resist a horizontal force equal to the weight of the fixtures.

D. Fixture Supports:
   1. Flush or recessed light fixtures and air terminals or services weighing **less than 56 pounds** may be supported by attachment directly to the runners but, in addition, they must have a minimum of two 12 gage slack safety wires attached to the fixture at diagonal corners and anchored to the structure above.
   2. All flush or recessed light fixtures and air terminals or services weighing **56 pounds or more** must be independently supported by not less than four taut 12 gage wires each attached to the fixture and to the structure above. The four taut 12 gage wires including their attachment to the structure above must be capable of supporting four times the weight of the unit.
   3. Support pendant mounted light fixtures directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting four times the weight of the fixture.

END OF SECTION 09 2220

SECTION 09 2400 - CEMENT PLASTER

PART 1 - GENERAL

1.1 SUMMARY

A. Provide lath and plaster where indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 06 1000: Plywood sheathing.
3. Section 07 2710: Air barrier membrane, mock-up.
4. Section 07 6200: Flashing and sheet metal.
5. Section 07 9210: Elastomeric joint sealants.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit 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.
3. Samples:
a. Submit samples of the proposed accessories.
b. Provide 24" x 24" finish coat samples (on 1" foam board) of each plaster texture for approval by Architect 14 days prior to commencing work.

1.3 QUALITY ASSURANCE

A. In addition to complying with pertinent codes and regulations of governmental agencies having jurisdiction, comply with materials handling and workmanship provisions of the "Reference Specifications" of the California Lathing and Plastering Contractors Association. Interior and exterior lath and plaster shall comply with CBC Chapter 25.

B. Colors: Provide finish selections indicated in the Finish Schedule.
1. Acceptable Manufacturers: The products and manufacturers specified in the Finish Schedule are for purposes of establishing color and quality. Refer to each Specification Section for additional manufacturers and Section 01 2500 for substitution requirements.
2. Manufacturer’s Standard Colors and Finishes: Where Finish Schedule specifies a manufacturer’s standard color or finish, Architect makes no guarantee that matching colors or finishes are available as other manufacturer’s “standard colors” from the listing of acceptable manufacturers. Contractor shall be responsible for providing colors matching those indicated on the Drawings.
3. Custom Colors: Where Finish Schedule indicates a specific manufacturer’s colors, other acceptable manufacturers shall provide matching custom colors where a standard color is not acceptable.

1.4 SPECIAL WARRANTY

A. In addition to the warranty requirements of the Contract Documents, submit 2 original copies of a warranty

from the acrylic finish coat manufacturer for fading, delamination, and defective materials with an extended correction period of **3-years.**

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 LATH

A. Provide corrosion resistant lath and lath accessories.

B. Welded Wire Metal Lath: ASTM C933; galvanized, self-furring.
1. Wood and Metal Vertical Supports:
a. 16" On-center: 1.00 lb/sq yd, 1-1/2" square openings; Structalath III by Structa Wire Corp., IAPMO ER 2017.
b. 24" On-center: 2.2 lb/sq yd, 2" square openings; V-Truss Wall & Ceilings by Structa Wire Corp., IAPMO ER 2017.
2. Wood and Metal Horizontal Supports:
a. Maximum 24" On-center: 2.2 lb/sq yd, 2" square openings; V-Truss Wall & Ceilings by Structa Wire Corp., IAPMO ER 2017.

C. Paper Backing (Water Resistive Barrier): Asphalt-impregnated Type "D" paper; CBC Section 2510.6.

D. Self-Furring Lath:
1. Use of self-furring lath is permitted subject to satisfactory job-site demonstration of installation.
2. Lath shall be furred out 1/4" when installed over solid surfaces such as plywood; DSA IR 25-4.

E. Lath Fasteners:
1. Staples:
a. At vertical wood supports: Minimum 16 gauge, minimum 3/4" crown, of sufficient length to penetrate sheathing and framing members minimum of 1" into wood structural members.
b. At horizontal wood supports: Minimum 9 gauge, barbed, minimum 3/4" crown, of sufficient length to penetrate sheathing and framing members minimum of 1-1/2" into wood structural members.
2. Nails: 6d common or roofing nail with 7/16" head, 3/4" minimum embedment into stud exclusive of sheathing; ASTM C1063.
3. Screws: 7/16" pan wafer head, Type S, 0.120" shank; ASTM C1002 and/or C 954.
a. Into Wood: #12 zinc pan head; 5/8" minimum penetration into wood.
1) 1-1/4" minimum penetration into stud where applying lath over insulation board.
b. Into Metal: Self-drilling and tapping; penetrate steel thickness plus 3 threads.
4. Powder Actuated Fasteners: Use fastener recommended for the specific use intended.
a. For concrete and masonry substrates only.
b. Factory washer (disc).
c. Demonstrate a minimum 50 pound pull out value.
d. 1-1/4" minimum embedment.

2.3 METAL ACCESSORIES

A. Metal Corner Beads: Prefabricated, No. 1A expanded metal corner bead, small nose corner beads fabricated

from zinc alloy, with expanded flanges of large mesh diamond lath to allow full encasement by plaster.

B. Casing Beads: Prefabricated, No. 66 short flange casing bead, square-edged style, with short flange, zinc-coated galvanized steel.

C. Control Joints - One Piece Type: Prefabricated, No. 15 expansion joint; Folded pair of non-perforated screeds in M-shaped configuration, with expanded flanges, zinc-coated galvanized steel.

D. Weep Screed: Prefabricated, No. 7 foundation sill screed o J-weep; zinc-coated galvanized steel with nailing flange.

E. Inside Corner Control Joint: Prefabricated No. 30, folded pair of non-perforated screeds in W-shaped configuration, with expanded flanges.

F. Vent Screed: Stockton Products SBS BugStop Soffit Vent, 1/8” diameter holes.

G. Reveal Screed: Stockton Products SVR - No Vent.

H. Column Collar: Fry Reglet Plaster Column Collar Molding.

2.4 PLASTER

A. Comply with ASTM C926 for Portland cement plaster base and finish coat mixes as applicable bases, materials and other requirements indicated.
   1. Portland Cement, ASTM C150, Type II or IV.
   2. Plastic Cement: ASTM C1328; no additional lime or plasticizer shall be added.
   3. Sand Aggregate for Base Coat: ASTM C897.

B. Portland Cement Plaster Base Coat Mixes and Compositions: Proportion materials for respective base coats in parts by volume for cementitious material and in parts by volume per sum of cementitious materials for aggregates to comply with the following requirements for each method of application and plaster base indicated. Adjust mix proportions below within limits specified to attain workability.
   1. Three coat work over metal lath.
   2. Scratch Coat: 1 part Portland cement plaster, 2-1/2 to 4 parts sand.
   3. Brown Coat: 1 part Portland cement plaster, 3 to 5 parts sand.

C. Polymer-Based Exterior Finish Coat: 100% acrylic polymer finish coat with integral color as indicated on the Finish Schedule, applied over stucco brown coat; Standard Finish by Dryvit Systems, Inc., Senerflex Finish by Senergy, or Sto Powerwall Finish by Sto Corp.

2.5 OTHER MATERIALS

A. Water for Mixing and Finishing Plaster: Drinkable, free of substances capable of affecting plaster set or of damaging plaster, lath or accessories.

B. Bonding Agent for Portland Cement Plaster: ASTM C932.

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 WATER-RESISTIVE BARRIER INSTALLATION

A. General: Install 2 layers water resistive barrier over all sheathing, or continuous insulation where occurs.

1. Install 1 layer over air barrier specified in Section 07 2710.
2. Install with minimum 2" horizontal laps and 6" vertical laps.
3. Water resistive barrier is not required on ceilings or soffits.

B. Integrate water resistive barrier with flashings such that water resistive barrier always laps over flashing.

C. Install water resistive barrier taut with a minimum of wrinkles and with care to eliminate punctures, tears or rips during application and the application of metal lath.

D. Repair holes, tears or rips.

3.3 LATH INSTALLATION

A. Lath: CBC Section 2507.3 and 2510.
1. Welded Wire Lath: Fasteners shall engage vertical cross wires at the furring crimps, at the intersection of longitudinal wire and cross wire, or at any point along the longitudinal wire.

B. Fastener Spacing:
1. Space fasteners at 6" on center along supports.
2. Bend common nails over to engage not less than 3 strands of lath.

C. Soffit Earthquake Nailing: At horizontal soffits, provide additional fasteners along each support and within 3" of the edge of each sheet; 9 gage ring-shank hook staple, 3/4" wide hook, 1-1/2" long.

3.4 INSTALLATION OF PLASTERING ACCESSORIES

A. Comply with referenced lathing and furring installation standards for provision and location of plaster accessories of type indicated.
1. Miter or cope accessories at corners; install with tight joints and in alignment.
2. Attach accessories securely to plaster bases to hold accessories in place and alignment during plastering.

B. Corner Bead: Install at external corners.

C. Casing Beads: Install at termination of plaster work unless otherwise indicated.

D. Control Joints: Install control joints at locations indicated, or if not indicated, at locations complying with the following criteria and approved by the Architect. Lath shall not be continuous through control joints, but shall be stopped and tied at each side.
1. Where expansion or control joint occurs in construction directly behind plaster membrane.
2. Where distance between control joints in plastered surface exceeds 144" in either direction.
3. Where area within Portland Cement panels exceed 100 sq. ft.
4. Where Portland Cement plaster panel sizes or dimensions change. Extend joints full width or height of plaster membrane.
5. At corners of door and window frames.
6. Directly over changes in substrate materials.

E. Install accessories flush with metal frames and other built-in items unless otherwise indicated.

3.5 PLASTER APPLICATION

A. Comply with all provisions of CBC Section 2512.

B. Portland Cement Plaster Application Standard: Apply Portland Cement plaster materials, compositions, and mixes to comply with ASTM C926. In addition to specified standards, apply plaster as follows:
   1. Scratch coat: Score scratch coat horizontally only to achieve a mechanical bond with the brown coat.
   2. Cold Joints: Cold joints in plaster will not be permitted within a panel, or between screeds, joints, or reveals.

C. Tolerances: Do not deviate more than 1/8" in 10'-0" from a true plane in finished plaster surfaces, as measured by a 10'-0" straightedge placed at any location on surface.

D. Plaster flush with metal frames and other built-in metal items or accessories which act as a plaster ground, unless otherwise indicated. Where plaster is not terminated at metal by casing beads, cut base coat free from metal before plaster sets and groove finish coat at the junctures with metal.

E. Walls: Provide 7/8" thick three 3-coat plastering method on walls (3/4" base + 1/8" finish).

F. Ceilings and Soffits: Provide 3/4" thick three 3-coat plastering method on ceilings and soffits.

G. Concealed Plaster: Where plaster application will be concealed by wood paneling, above suspended ceilings and similar locations, finish-coat may be omitted; where concealed behind cabinets and similar furnishings and equipment, apply finish-coat; where used as a base for adhesive application of tile and similar finishes, omit finish-coat and coordinate thickness with overall dimension as shown, and comply with tolerance specified.

H. Number of Coats: Apply Portland Cement plaster, of composition indicated, using 3-coat work over the following plaster bases: Metal lath, scratch coat, brown coat, finish coat.

3.6 CURING

A. Moist cure Portland Cement plaster base and finish coats to comply with ASTM C926, including recommendations for time between coats and during in "Annex A2 Design Considerations".

B. Keep cement basecoat hydrated and allow the cement to chemically cure and harden. Moist cure as needed, morning and evening as required to produce a hard basecoat.

C. Basecoat shall be allowed to cure a minimum of 7 days before applying a finish coat. If feasible allow the basecoat to cure 14 days prior to applying the finish coat.

D. Plastered walls with excessive shrinkage cracks in the basecoat due to a failure to water cure shall be skim coated with a polymer-based cement coat prior to applying a finish coat.

3.7 FINISH COAT

A. Finish Coat Application:
   1. Apply finish coat to match mock-ups in color and texture.
   2. Acrylic Finish Coat: Apply a primer coat for light colored finishes or provide full prime coverage for all "putz" or "swirl" textures.
   3. Provide sufficient crew size to maintain a wet edge; scaffold lines shall be kept to a minimum.
   4. Maintain consistency and uniformity in application procedures and techniques.
   5. Leave adjacent surfaces clean and free of plaster materials.
   6. Leave protection of the plaster in place until finish coat is set.
   7. Repair scaffold tie-is to maintain water-resistance of plaster assembly and blend with finish coat.

B. Texture:

1. Acrylic Finish Coat and Texture: "Sandblast" as illustrated by Dryvit Systems, Inc.

C. Protect finish coat in compliance with manufacturer's recommendations.

3.8 CLEANING UP

A. Promptly wipe metal accessories, and other surfaces which are not to be plastered, clean after application of each coat.

B. In addition to other protection, protect and clean adjacent surfaces from the accidental application of plaster.
C. In addition to other requirements for cleaning, immediately upon completion of this portion of the Work visually inspect adjacent surfaces and remove all traces of spilled and splashed plaster.

3.9 FIELD QUALITY CONTROL

A. Lath Inspection: No lath or lath attachments shall be covered or finished until it has been inspected and approved by the Project Inspector or special inspector.

END OF SECTION 09 2400

SECTION 09 2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Provide gypsum drywall and accessories where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Section includes:
1. Gypsum wallboard and accessories.
2. Joint treatment and accessories.
3. Tackboard.
5. Metal furring channels.

C. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 06 1100: Rough carpentry.
3. Section 07 5110: Substrate board for Class A built-up roof system.
4. Section 09 2115: Shaft wall assemblies.
5. Section 09 2220: Gypsum wallboard ceiling suspension systems.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop drawing indicating proposed control joint layout.

1.3 REFERENCES

A. All work shall be performed in accordance with the Drawings and Specifications, and with the following standards:
1. GA-214 - Recommended Levels of Gypsum Board Finish; Gypsum Association; 2007.
2. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2007.
3. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association.
4. GA-600 - Fire Resistance Design Manual; Gypsum Association.

1.4 QUALITY ASSURANCE

A. Drywall installer shall coordinate with General Contractor to ensure that substrates at the ceiling line, base, and door/window frames are within a tolerance of straight, not-to-exceed 1/8" in 10', as indicated by a 10' straight edge. General Contractor shall shim as required prior to drywall installer accepting substrates. Failure to maintain the tolerances will require removal and reinstallation at no additional cost to the Owner.

B. Mock-Ups:
1. At a location on the site where approved by the Architect, provide a mock-up gypsum wallboard panel.
a. Make the panel approximately 2'-0" square.
b. Provide one mock-up panel for each gypsum wallboard finish used on the Work.
c. Revise as necessary to secure the Architect's approval.

2. The mock-up panels, when approved by the Architect, will be used as datum points for comparison with the remainder of the work of this Section for the purpose of acceptance or rejection.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 GYPSUM WALLBOARD

A. Fire-Resistant Gypsum Wallboard: Paper-faced gypsum panels, ASTM C1396; sizes to minimize joints in place; edges tapered, ends square cut; Type X, 5/8" thick in all locations unless otherwise noted.

B. Water-Resistant, Fire-Resistant, Gypsum Wallboard: Water-resistant gypsum backing board, ASTM C1396; sizes to minimum joints in place; edges tapered, ends square cut; Type X, 5/8" thick, in widths and lengths as will result in a minimum of joints. Use at walls and ceilings of all restrooms, locker rooms, kitchens (and related food preparation and clean up rooms), unless otherwise note.

2.3 METAL ACCESSORIES

A. Finishing Accessories: ASTM C1047; galvanized steel or rolled zinc, unless otherwise indicated.

B. Casing Beads:
1. Provide channel shapes with an exposed wing, and with a concealed wing not less than 7/8" wide.
2. Provide bullnose shapes where shown on Drawings, as manufactured by Flannery, Inc., Clinch-On Corner Bead Co.

C. Corner Beads:
1. Provide angle shapes with wings not less than 7/8" wide and perforated for nailing and joint treatment at horizontal edges.
2. Provide bullnose shapes at vertical edges and where indicated on the Drawings.

D. Control Joints:
1. Provide with 1/4" wide center channel with removable tape strip and wings perforated for nailing and joint treatment at horizontal edges as manufactured by Clark Dietrich, 093 Vinc Control Joint (ZNCJ).

E. Edge Beads at Ceiling Perimeter:
1. Provide angle shapes with wings not less than 3/4" wide.
2. Provide concealed wing perforated for nailing, and exposed wing edge folded flat.
3. Exposed wing may be factory finished in white color.

F. Reveals: Extruded aluminum, alloy 6063-T5, with prepunched mounting flanges tapered to receive joint bedding, tape and top coat. Factory chromate conversion coating. As manufactured by Fry Reglet Corp., Gordon Inc., MM Systems Inc.

2.4 FASTENING DEVICES

A. Wood Framing: No. 6 Type W, bugle-head screws, length as required for single or multi-layer application; ASTM C1002.

B. Metal Framing: No. 6 Type S, bugle-head screws, length as required for single or multi-layer application; ASTM C1002.

2.5 JOINTING SYSTEM

A. Provide a jointing system, including reinforcing tape and compound, designed as a system to be used together and as recommended for this use by the manufacturer of the gypsum wallboard approved for use on the Work. ASTM C 475.

B. Jointing compound may be used for finishing if so recommended by its manufacturer.

C. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

2.6 TEXTURE

A. Primer: Manufacturer's recommended acrylic latex coating. Tuff Hide by USG.

B. Texture Material: Manufacturer's recommended product for the finish texture specified.

2.7 TACKBOARD AND SOUNDBOARD

A. 1/2" thick, with factory-primed face, specifically formulated as a backing for vinyl wallcovering.
   1. Side to which the vinyl wallcovering will be bonded shall be smooth, laminating quality.
   2. Class II (Flame Spread 26-75).

B. Acceptable Products:
   1. Industrial Insulation Board by Wood Fiber Industries.
   2. Micore 300 Board by USG Interiors, Inc.

2.9 SHEET METAL FURRING CHANNELS

A. Furring Channels:
   1. Hat-shaped with 2 equal legs and flanges, size as indicated on the drawings, 24 gage (0.0179 in.) minimum steel thickness.
   2. Z-shaped, slotted or unslotted web, face flange of 1-1/4", wall attachment flange of 7/8", 24 gage (0.0179 in.) minimum steel thickness, depth required to fit insulation thickness indicated.

B. Resilient Channels: Single-leg type with screw flange, punched leg, and top flange, 1/2" high, 24 gage (0.0179 in.) minimum steel thickness.

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 INSTALLATION

A. General:
1. Install gypsum wallboard in accordance with the Drawings and with separate boards in moderate contact but not forced in place.
2. At internal and external corners, conceal cut edges of the boards by overlapping covered edges of abutting boards.
3. Stagger boards so that corners of any four boards will not meet at a common point except in vertical corners.

B. Ceilings:
1. Install gypsum wallboard to ceilings with the long dimension of the wallboard at right angles to the supporting members.
2. Maximum Fastener Spacing: 12" on center for screw fastening.

C. Walls:
1. Install gypsum wallboard in vertical direction, plumb and square and in full height single piece sheets wherever possible.
   a. Gypsum wallboard may be installed in horizontal direction behind vinyl covered tackboard panels.
2. Make end joints, where required, over framing, furring members, or solid backing.
3. Butt factory edges together. Do not butt a factory edge with a cut edge.
4. Maximum Fastener Spacing: 16" on center for screw fastening.

D. Tackboard:
1. Install tackboard over gypsum board or plywood in vertical direction, plumb and square and in full height single piece sheets wherever possible.
2. Use maximum size sheets to minimize joints. Cut sheets only as required.
3. Open all fiberboard packages and place fiberboard pieces singly around the room at least 24 hours before application.
4. Apply tackboard allowing 1/8" gap between boards and fasten to studs as noted in 3.2.C.
5. Provide fiberglass or polyester tape at joints.

3.3. SHEET METAL FURRING

A. Hat Channels (Resilient Channels similar):
1. Attach sheet metal furring channels by screws, nails, or bolts as best suited for the type of stud.
2. Install channels horizontally starting 2" above the finished floor and vertically spaced as recommended by the manufacturer for the total thickness of the surfacing, but not exceeding 16" on center. Splice by nesting channels not less than 8" and securely wire tie.
3. Install resilient channels "free" edge up.

B. Z-Furring:
1. Erect insulation vertically and hold in place with Z-furring members spaced at 24" on center.
2. Except at exterior corners, attached narrow flange of furring members to wall with fasteners spaced at 24" on center.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel.
4. At interior corners, space second member no more than 12" from corner and cut insulation to fit.

3.4 JOINT TREATMENT

A. General:
1. Inspect areas to be joint treated, verifying that the gypsum wallboard fits snugly against supporting framework.
2. Unless specified otherwise, treat all joints on gypsum face panels. Refer to level of finish required below.
3. In areas where joint treatment and compound finishing will be performed, maintain a temperature of not less than 55 degrees for 24 hours prior to commencing the treatment, and until joint and finishing compounds have dried.
4. Provide a minimum drying time of 24 hours between coats, with additional drying time in poorly ventilated areas.

B. Embedding Compounds:
1. Apply to gypsum wallboard joints and fastener heads in a thin uniform layer.
2. Spread the compound not less than 3" wide at joints, center the reinforcing tape in the joint, and embed the tape in the compound. Then spread a thin layer of compound over the tape.
3. After this treatment has dried, apply the number of coats of embedding compound to joints and fastener heads for the level of finish specified for the surface, spreading in a thin uniform coat to not less than 6" wide at joints, and feather edged.
4. Sand between coats as required.
5. When thoroughly dry, sandpaper to eliminate ridges and high points.

C. Finishing Compounds:
1. After embedding compound is thoroughly dry and has been completely sanded, apply a coat of finishing compound to joints and fastener heads.
2. Feather the finishing compound to not less than 12" wide.
3. When thoroughly dry, sandpaper to obtain a uniformly smooth surface, taking care to not scuff the paper surface of the wallboard or raise the nap of the gypsum board paper facing.

D. Tackboard:
1. Hand tape joints in tackboard with a hardening-type joint compound having a maximum hardening time of approximately 1-1/2 hours.
2. Apply compound so as to force material into the 1/8" gap between boards.
3. Allow tape embedding application to thoroughly dry prior to the finish application. The finish application shall be Kaiser Dual-Purpose Pre-Mix Joint Compound.

E. Backing Board: 5/8" Type “X” gypsum board, unless otherwise noted.
1. Treat all joints behind fiberglass reinforced panels.
2. Joints behind vinyl covered tackable panels are not required to be treated.

F. Gypsum Board at Fire Rated Construction: Comply with UL fire listed assemblies, or other fire rated assemblies.

3.5 LEVELS OF FINISH

A. The following descriptions of levels of finish are in accordance with GA-214. Finish gypsum board and tackboard in accordance with the Gypsum Construction Handbook as published for the construction industry by United States Gypsum Company.

B. **Level 1:** Embed tape in joint compound at all joints and interior angles. Surface free of excess joint compound. Tool marks and ridges are acceptable.
1. Provide Level 1 finish on surfaces hidden above a ceiling or soffit at sound walls, fire-rated walls, and exterior walls.
2. Provide Level 1 finish on surfaces hidden behind tack board.

C. **Level 3:** Embed tape in joint compound, and provide one additional coat of compound, over all joints and interior angles. Provide two separate coats of compound over accessories and fasteners. All joint compound shall be smooth and free of tool marks and ridges.
   1. Provide Level 3 finish on all exposed finished or unfinished gypsum board surfaces not specified to receive Level 4 or 5 finish.
   2. Provide Level 3 finish behind fiberglass reinforced panels installed over gypsum backing board.

D. **Level 4:** Embed tape in joint compound, and provide two additional coats of compound, over all joints and interior angles. Provide three separate coats of compound over accessories and fasteners. All joint compound shall be smooth and free of tool marks and ridges. All joint compound shall be smooth and free of tool marks and ridges.
   1. Provide Level 4 finish where vinyl wall covering or dry-erase wall covering is installed on gypsum board surfaces.

E. **Level 5:** Embed tape in joint compound, and provide two additional coats of compound, over all joints and interior angles. Provide three separate coats of compound over accessories and fasteners. All joint compound shall be smooth and free of tool marks and ridges. A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.
   1. Provide Level 5 finish on all tackboard surfaces to receive field-applied vinyl wallcovering.

3.6 CORNER TREATMENT AND METAL ACCESSORIES

A. Internal Corners: Treat as specified for joints, except fold the reinforcing tape lengthwise through the middle and fit neatly into the corner.

B. External Corners:
   1. Install the specified corner bead, fitting neatly over the corner and securing with the same type fasteners used for installing the wallboard.
   2. Space the fasteners approximately 6" on centers, and drive through the wallboard into the framing or furring member.
   3. After the corner bead has been secured into position, treat the corner with joint compound and reinforcing tape as specified for level of finish specified for the surface, feathering the joint compound out from 8" to 10" on each side of the corner.

C. Control Joints:
   1. Walls and ceilings: Install at 30’-0” o.c. maximum spacing in either direction when planes exceed 30’-0” in length.
   2. Unless locations are specifically indicated on the Drawings, Contractor shall submit a control joint plan for the architect’s review.

3.7 OTHER METAL TRIM

A. General: The Drawings do not purport to show all locations and requirements for metal trim. Carefully study the Drawings and the installation, and provide all metal trim normally recommended by the manufacturer of the gypsum wallboard approved for use in this Work.

3.8 TEXTURE

A. Exposed Wall Surfaces for Paint: Provide fine orange peel finish approved by Architect on exposed gypsum board surfaces.

B. Exposed Ceiling and Soffit Surfaces for Paint: Provide fine orange peel finish approved by Architect on exposed gypsum board surfaces.

C. Provide the manufacturer's recommended primer/sealer to surfaces to receive texture prior to texturing.

3.9 MARKING AND IDENTIFICATION (CBC 703.7)

A. At all accessible concealed floors, floor-ceilings and/or attic spaces with fire walls, fire barriers, fire partitions, smoke barriers and/or smoke partitions or any other wall required to have protected openings or penetrations provide signs or stencil as follows:
   1. Located within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the wall or partition.
   2. Letting shall be not less than 3 inches in height with a minimum 3/8 inch stroke in contrasting color stating, "FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS".

3.10 CLEANING UP

A. In addition to other requirements for cleaning, use necessary care to prevent scattering gypsum wallboard scraps and dust, and to prevent tracking gypsum and joint finishing compound onto floor surfaces.

B. At completion of each segment of installation in a room or space, promptly pick up and remove from the working area all scrap, debris, and surplus material of this Section.

END OF SECTION 09 2900

SECTION 09 3000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide tile where called for on the Drawings, as specified herein, and as needed for a complete and proper installation. Section includes:
   1. Tile for floor applications
   2. Tile for wall applications
   3. Tile wall base
   4. Backer board as tile substrate
   5. Trim, accessories and setting materials

B. Related Sections:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
   2. Section 07 1310: Sheet waterproofing.
   3. Section 07 9210: Sealing and caulking of expansion joints and other joints.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
   1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
   2. Installation Procedures: Submit manufacturers recommended installation procedures.
   3. Samples:
      a. Tile: Submit sufficient samples of each size, color, and texture to demonstrate the maximum range of sizes, colors, textures, and flatness. Tiles delivered to the job or installed in the Work, and which do not fall within the accepted range, shall be removed from the site and be replaced promptly with acceptable materials.
      b. Trim shapes and base: Review any unusual installation conditions with the Architect for approval prior to commencing the work.
   4. **Verify availability of all parts, in all colors required, at time of submittal.**

B. Contract Closeout Submittals: Submit in accordance with Section 01 7700.
   1. Manufacturer's recommended cleaning procedures.

1.3 QUALITY ASSURANCE

A. Applicable Standards: The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this Specification to the extent they are specified herein. Unless otherwise specified, use the latest edition.
   1. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile - Version; 2014.
   2. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2022.
   3. Tile Council of America (TCA): Comply with the Handbook for Ceramic Tile Installation.

B. Colors: Provide finish selections indicated in the Finish Schedule.
   1. Acceptable Manufacturers: The products and manufacturers specified in the Finish Schedule are for purposes of establishing color and quality. Refer to each Specification Section for additional manufacturers and Section 01 2500 for substitution requirements.

2. Manufacturer's Standard Colors and Finishes: Where the Finish Schedule specifies a manufacturer's standard color or finish, the Architect makes no guarantee that matching colors or finishes are available as other manufacturer's "standard colors" from the listing of acceptable manufacturers. The Contractor shall be responsible for providing colors matching those indicated on the Drawings.
3. Custom Colors: Where the Finish Schedule indicates a specific manufacturer's colors, other acceptable manufacturers shall provide matching custom colors where a standard color is not acceptable.

C. Blending:
1. Require the tile manufacturer to blend tiles at the factory.
2. Provide additional blending at the job site as needed to secure the Architect's approval.
3. All materials of each specific type and color **shall be from the same dye-lot or run.**
4. Provide additional lighting if necessary prior to starting tile installations.

D. Provide only tile cartons which have been grade-sealed by the manufacturer in accordance with ANSI A137.1, and with grade-seals unbroken.

E. On manufactured grouts, provide labels certifying compliance with the referenced standards.

1.4 SITE CONDITIONS

A. Install mortar, and set and grout the tile, only when temperature is at least 50° F and rising in the space.

B. Protection:
1. Protect adjacent surfaces during progress of the work of this Section.
2. Close rooms and spaces to traffic of all types until mortar and grout have set for 72 hours.

C. Illuminate the work area during installation, providing the same level and angle of illumination as will be available for final inspection.

1.5 EXTRA MATERIALS

A. Materials: Provide for the Owner's use, an extra stock of approximately 3% of each type, color, pattern, and size of material installed. Package each type of material separately, distinctly marked, and protected against deterioration and damage.

B. Deliver materials to the Inspector of Record along with an inventory list of items provided. Obtain and forward to the Architect, a signed receipt from the Inspector accepting delivery.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01620.

B. Manufacturers: As indicated on the Finish Schedule.

2.2 CERAMIC TILE

A. Except as may be otherwise specified or approved by the Architect, provide floor tiles **with coefficient of friction of 0.42** or higher in accordance with pertinent provisions of ASTM C1028.

B. Ceramic Mosaic Floor Tile, Unglazed:
   1. Type: Ceramic Mosaic
   2. Size: 2"x 2"
   3. Catalog number and/or color: See Finish Schedule
   4. **Note:** Provide ceramic mosaic with 7.5% abrasive content at shower floors.

C. Interior Wall Tile, Glazed:
   1. Type: Glazed Ceramic
   2. Size: 4-1/4" x 4-1/4"
   3. Catalog number and/or color: See Finish Schedule

D. Exterior Wall Tile, Clearglazed:
   1. Type: Glazed Porcelain
   2. Size: 3" x 3" with 1/8" grout joints
   3. Colors: D175 - 50%, D322 - 30%, D179 - 20%, with Prism #502 grout by Custom Building Products.
   4. Pattern: Random blend.

E. Provide standard trim shapes as required.
   1. Provide all bases, caps, stops, returns, trimmers, and other shapes indicated or required to produce a completely finished installation.
   2. Unless otherwise noted on the Drawings, provide color and finish matching the adjacent tile.
   3. **All interior and exterior wall corners shall be standard bullnose units** unless otherwise noted.
   4. Verify with Architect any conflicting conditions prior to installation.

2.3 INSTALLATION MATERIAL

A. All materials, including mortar bed, metal lath, membranes, bond coats, etc. shall be in strict compliance with the CTA Handbook for Ceramic Tile Installation.

B. Portland Cement Mortar Bed: Provide materials in accordance with ANSI A108.1 and the TCA setting method specified below.
   1. Membrane: 15 pound roofing felt or 4 mil polyethylene film (required in wet areas only)
   2. Portland Cement: ASTM C150, Part 1.
   3. Lime: ASTM C206, Type S or ASTM C207, Type S.
   4. Sand: ASTM C144.
   5. Water: Potable.

C. Bond Coat:
   1. Latex-Portland Cement Mortar: ANSI A118.4. Ardex X77 Microtec fiber reinforced tile and stone mortar by Ardex Americas, Super Flex by TEC, ReFlex by Bostik, 254/255 by Laticrete, or Kerabond/Keralastic by Mapei, with manufacturers recommended acrylic latex additive.
   2. Epoxy: 100% solids; chemical, stain, and shock resistant; ANSI A118.3. Ardex WA Epoxy adhesive and grout by Ardex Americas, AccuColor EFX Epoxy by TEC, ExPoxy Ezclean by Bostik, Latapoxy 300 by Laticrete International, or Kerapoxy by Mapei Corp.

D. Grout:
   1. Epoxy Grout: 100% solids; chemical, stain, and shock resistant; ANSI 118.3. Ardex WA Epoxy grout and adhesive by Ardex Americas, AccuColor EFX Epoxy by TEC, EzPoxy Exclean by Bostik, Latipoxy 300 by Laticrete, or Kerapoxy by Mapei.

2.4 METAL TRIM

A. Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive; by Schluter-Systems or Profilitec.
   1. Applications:
      a. Open edges of wall tile.
      b. Open edges of floor tile.
      c. Wall corners, inside and outside.
      d. Transitions between floor finishes of different height.
      e. Thresholds at door openings.
      f. Borders and other trim as indicated on the Drawings.

2.5 CAULKING

A. Ceramic Tile Caulk:
   1. Sanded: Polyblend Ceramic Tile Caulk by Custom Building Products, Ardex SX 100% Silicone sealant for tile and stone by Ardex Americas or approved equal.
   2. Non-Sanded: Polyblend Ceramic Tile Caulk by Custom Building Products, Ardex SX 100% Silicone sealant for tile and stone by Ardex Americas or approved equal.

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.**

B. Coordinate with other trades as needed to assure that proper substrata are provided to receive the work of this Section.

C. Where a Portland cement mortar setting bed will be installed, do not commence installation of the setting bed until substrata are within the following tolerances:
   1. Horizontal surfaces: Level within 1/4" in ten ft in all directions;
   2. Vertical surfaces: Plumb within 1/4" in eight ft in all directions.

D. Where tile units will be thin-set directly to the substrata, do not commence installation of the tile units until substrata are within the following tolerances:
   1. Horizontal surfaces: Level within 1/8" in 10'-0" in all directions;
   2. Vertical surfaces: Plumb within 1/8" in 8'-0" in all directions.

E. Condition of surfaces to receive tile:
   1. Verify that surfaces to receive mortar setting bed and tile are firm, dry, clean, and free from oily or waxy films and curing compounds.
   2. Verify that grounds, anchors, plugs, recess frames, bucks, electrical work, mechanical work, and similar items in or behind the tile have been installed before proceeding with installation of mortar bed or tile.

F. Tile at Dissimilar Materials:
   1. Where tile will be set over dissimilar substrates, i.e. wood and masonry in the same plane, provide and install Dal-Seal CIS - Crack isolation sheet membrane, or approved equal.
   2. Provide for 1/4" full depth gap between tile and metal door frames. Fill with mildew resistant silicone sealant.

3. Provide for movement of dissimilar substrate materials by using mildew resistant silicone sealant at nearest grout joint.

3.2 SETTING METHOD

A. Use setting method of the types indicated and required in accordance with TCA Handbook of Ceramic Tile Installation as specified below.

B. Interior Walls:
1. **Wood or Metal Stud with Mortar Bed:** W231 with latex Portland cement bond coat on a cured mortar bed; membrane, plain lath, mortar bed and scratch coat - ANSI A108.1A, tile - ANSI A108.1B, and grout - ANSI A108.3. Provide expansion joints and cold joints at all interior and exterior corners in accordance with TCA Movement Joint Design Essentials EJ171.

C. Interior Floors:
1. **Concrete:** F112 with latex Portland cement mortar bond coat on a cured mortar bed; mortar bed bond coat, mortar bed - ANSI A108.1a, tile - ANSI A108.1B, and grout - ANSI A108.3.
2. **Concrete (Thin-set):** F115 with epoxy cement bond coat; bond coat - ANSI A118.4, tile - ANSI A108.1B, and grout - ANSI A108.3. Provide expansion joints and cold joints at all interior and exterior corners in accordance with TCA Movement Joint Design Essentials EJ171.

D. Interior Base Only, No Wall Tile Above:
1. **Studs and Gypsum Board:** W221 with latex Portland cement mortar bond coat on a cured mortar bed; membrane, self-furring metal lath, mortar bed with scratch coat - ANSI A108.1B, tile - ANSI A108.1B, and grout - ANSI A108.10.

3.3 TILE INSTALLATION

A. General:
1. **Prior to installation, verify layout of patterns and transitions with the architect for approval.**
2. Comply with pertinent provisions of the referenced standards and the product manufacturer's installation recommendations, except as otherwise directed by the Architect or specified herein.
3. Maintain minimum temperature limits and installation practices recommended by materials manufacturers.
4. Do not install tile floors over membrane until the membrane has been tested and accepted.
5. Mix and use proprietary materials in strict accordance with the manufacturers' printed instructions.
6. Prepare the surfaces, set, fit, grout, and clean the work of this Section in strict accordance with the referenced standards and the manufacturers' recommendations.
7. Provide adequate lighting to assure workman visibility for uniform tile setting.

B. Install in accordance with pertinent provisions of the standards listed in 1.3 above, pressing and beating tile into place to obtain 100% coverage by mortar on back of each tile. Back-butter tiles if necessary to achieve 100% coverage.

C. Limits of Tile:
1. Extend tile into recesses and under equipment and fixtures to form complete covering without interruptions.
2. Terminate tile neatly at obstructions, edges, and corners, without disruption of pattern or joint alignment.

D. Joining Pattern:
1. Lay tile in grid pattern unless otherwise indicated on the Drawings or directed by the Architect.
2. **Align joints** when adjoining tiles on floor, base, trim, and walls are the same size.
3. Layout tile work, and center the tile fields both directions in each space or on each wall area.

4. Adjust to minimize tile cutting.
5. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size.
6. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

E. Allowable Variations in Finished Work: Do not exceed the following deviations from level and plumb, and from elevations, locations, slopes, and alignments shown:
1. Horizontal surfaces: 1/8" in ten ft in all directions;
2. Vertical surfaces: 1/8" in eight ft in all directions;
3. Adjacent tiles flush.

3.4 THRESHOLDS

A. EDGE STRIPS: Install edge strips at openings where threshold has not been called for, but where tile floor abuts other flooring material at same level.

B. Where thresholds are detailed to be installed over tile, install with a full bedding of bonding mortar.

3.5 GROUTING

A. General:
1. Do not begin grouting floor tiles until they are firmly set and, in no case, in less than 48 hours after they have been installed.
2. Remove spacers, ropes, glue, and similar foreign matter prior to grouting.
3. When using proprietary grout, adhere strictly to the manufacturer's directions unless otherwise specified or approved by the Architect.

B. Installation:
1. Mix grout by hand or with a slow-speed drill motor not exceeding 300 rpm, achieving a stiff non-slumping, uniform consistency, and using the minimum amount of liquid to achieve a workable mix.
2. Force the maximum amount of the approved grout into joints in accordance with pertinent recommendations contained in ANSI standards specified.
3. Fill the joints of cushion-edge tile to depth of the cushion; fill joints of square-edge tile flush with the surface.
4. Fill all gaps and skips.
   a. Do not permit mortar or mounting mesh to show through grouted joints.
   b. Provide hard finished grout which is uniform in color, smooth, and without voids, pin holes, or low spots.
5. Leave tile clean.

3.6 CAULKING

A. Locations:
1. Caulk all tiled inside and outside corners with sanded caulking, color to match grout, in lieu of grout.
2. Caulk transition from wall tile to ceiling and wall with sanded caulking, color to match grout, in lieu of grout.
3. Caulk intersection of wall and ceiling tile to door and window frames with sanded caulking, color to match grout, in lieu of grout.

3.7 CURING

A. Damp cure all tile installations, including portland cement grouts, for 72 hours minimum.
1. Cover with 40 pound kraft paper.
2. Do not use polyethylene sheets directly over tile on horizontal surfaces.

3.8 CLEANING AND POLISHING

A. After completion of setting and grouting, thoroughly clean and polish the tile.
   1. Do not use acid or acid cleaners to clean tile.
   2. When epoxy resin grout is thoroughly cured, steam clean paraffin coating per manufacturer's recommendations.
   3. When the tile is thoroughly clean and dry, polish glazed tile with clean dry cloths.

3.9 PROTECTION AND REPLACEMENT

A. Protect finished tile work while other work in the area is in progress. Do not permit traffic on tile floors for 7 days after laying tile. Protect tile floors from traffic with heavy, non-staining paper held in place with non-staining masking tape.

B. Replace cracked, chipped, broken, and otherwise defective tiles.

C. Remove work not complying with requirements of the Contract Documents or the referenced standards, and promptly replace with work which does comply.

END OF SECTION 09 3000

SECTION 09 5100 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide acoustical ceilings where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 01 3560: High Performance Criteria Summary
3. Section 09 2900: Gypsum Wallboard System

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.
3. Samples: Submit four 4" x 4" samples of all acoustic ceiling tiles and/or panels specified. Submit two samples of all ceiling suspension system components. If other than components and manufacturer specified are submitted, provide four samples of each component system.

B. Contract Closeout Submittals: Comply with requirements of Section 01 7700.
1. Manufacturer's recommended cleaning procedures.

1.3 QUALITY ASSURANCE

A. Comply with ASTM C636 and E580, CBC Section 1616A1.21 and DSA IR 25-2.13.

B. Fire Performance Characteristics: Provide acoustical ceiling components identical to those tested for the following fire performance characteristics, according to ASTM test method indicated, by an independent testing and inspecting agency acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate marking of testing and inspection agency.
1. Surface Burning Characteristics:
a. Flame Spread: 0-25; ASTM E84.
b. Smoke Developed Index: 0-450; ASTM E84.

C. Colors: Provide finish selections indicated in the Finish Schedule.
1. Acceptable Manufacturers: The products and manufacturers specified in the Finish Schedule are for purposes of establishing color and quality. Refer to each Specification Section for additional manufacturers and Section 01 2500 for substitution requirements.
2. Manufacturer’s Standard Colors and Finishes: Where the Finish Schedule specifies a manufacturer’s standard color or finish, the Architect makes no guarantee that matching colors or finishes are available as other manufacturer’s “standard colors” from the listing of acceptable manufacturers. The Contractor shall be responsible for providing colors matching those indicated on the Drawings at no additional costs to the Owner.
3. Custom Colors: Where the Finish Schedule indicates a specific manufacturer’s colors, other acceptable manufacturers shall provide matching custom colors where a standard color is not acceptable at no additional costs to the Owner.

D. Ceiling grid installer shall coordinate with General Contractor to insure that substrates at the ceiling line are within a tolerance of straight, not-to-exceed 1/8" in 10', as indicated by a 10' straight edge. General Contractor shall shim as required prior to ceiling installer accepting substrates. Failure to maintain the tolerances will require removal and reinstallation at no additional cost to the Owner.

1.4 EXTRA MATERIALS

A. Materials: Provide for the Owner's use, an extra stock of 2 full boxes of each type, color, pattern, and size of material installed. Package each type of material separately, distinctly marked, and protected against deterioration and damage.

B. Deliver materials to the Inspector of Record along with an inventory list of items provided. Obtain and forward to the Architect, a signed receipt from the Inspector accepting delivery.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 SUSPENDED ACOUSTICAL CEILING SYSTEM

A. Suspension Systems: ASTM C635 and E580 Section 5; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required for a complete suspension system.

B. Acceptable Suspension System Products:
1. Series 1250 heavy-duty by Chicago Metallic Corp., ESR-2631:
   a. Main runner: No. 270.
   b. Cross runner: No. 1254 or 1274.
   c. Perimeter clip: No. 1496.
2. Prelude XL Heavy-duty by Armstrong, ESR-1308:
   a. Main runner: No. 7301.
   b. Cross runner: No. XL-7342.
   c. Perimeter clip: BERC-2.
3. Color:
   a. White at 2' x 2’ and 2’ x 4’ grids

C. Acceptable Acoustical Ceiling Panel Products: ASTM E1264, Class A.
1. **Type "A":** Fine Fissured Second Look - No. 1760 (NRC 0.55) by Armstrong; 24"x48"x3/4"(to look like 24" x 24" panels); Angled Tegular edge lay-in; flame spread 0-25; color white.

2. **Type "B":** School Zone Fine Fissured - No. 1714 (NRC 0.70) by Armstrong; 24"x48"x3/4"; square edge lay-in; flame spread 0-25; color white.

3. **Type "E":** Clean Room VL - 870 by Armstrong; 24"x48"x5/8"; square edge lay-in; flame spread 0; color white.

4. **Type "F":** Calla Square Lay-in Smooth Texture (NRC 0.85) by Armstrong; 24"x48"x1"; square edge lay-in; flame spread 0; color: white.

5. All acoustical ceiling panels within the same room shall come from the same die lot.

2.3 SUSPENDED DRYWALL CEILING SYSTEM

A. Suspension Systems: ASTM C635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required for a complete suspension system.

B. Acceptable Suspension System Products:
1. Drywall Suspension System by USG; ESR-1222:
a. Main runner: Fire-rated, heavy duty classification; DGLW26.
b. Cross runner: Fire-rated, heavy duty classification; DGLW424.

2.4 ACCESSORIES

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. Adhesive: Titebond Acoustical Ceiling Tile Construction Adhesive or approved equivalent.

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. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.

3.3 SUSPENSION SYSTEM INSTALLATION

A. Except as modified by requirements of governmental agencies having jurisdiction, recommendations of the manufacturer as approved by the Architect, or specific directions of the Architect, install in accordance with ASTM C636 and E580 Section 5, CBC Section 808, and pertinent UL design requirements.

B. Hanger Wires:
1. Provide 12 gauge minimum hanger wires for up to and including 4'-0" x 4'-0" grid spacing along main runners. Splices are not permitted in any hanger wires unless specifically approved by DSA.
2. Provide 12 gauge hanger wires at ends of all main and cross runners within 8" from the support and within 1/4 of length of end tee, whichever is least, for perimeter of ceiling area. End connections for runners which are designed and detailed to resist the applied horizontal forces may be used in lieu of 12 gauge hanger wires, subject to DSA review and approval.
3. Provide trapeze or other supplementary support members at obstructions to main hanger spacing.
4. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits or discontinuous areas.
5. Provide counter-sloping wires for hanger wires which are more than 1 in 6 out of plumb.

C. Perimeter Attachment:

1. Ceiling grid members may be attached to not more than two adjacent walls. Ceiling grid members shall be at least 3/4" free of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners shall be free and a minimum of 3/4" clear of wall.
2. At perimeter of ceiling area where main or cross runners are not connected to adjacent wall, provide interconnection between runners at free end to prevent lateral spreading.
    a. Metal strut or a 16 gauge wire with a positive mechanical connection to the runner may be used.
    b. Where the perpendicular distance from the wall to the first parallel runner is 12" or less, this interlock is not required.

D. Bracing Wires: Provide sets of four 12 gauge splayed bracing wires oriented 90 degrees from each other at following spacing:
1. Provide sets of bracing wires at a spacing not more than 12'-0" x 12'-0" on center.
2. Provide bracing wires at locations not more than 6'-0" from each perimeter wall and at edge of vertical ceiling offsets.
3. Slope of splayed bracing wires shall not exceed 45 degrees from plane of ceiling and shall be taut without causing ceiling to lift. Splices in bracing wires shall not to be permitted without special DSA approval.
4. Fasten a strut to main runner at the convergence of the splayed wires, extended to and fastened to roof or floor structural members above or to such other framing deemed acceptable to enforcement agency.
    a. Place these vertical restraint points not more than 12'-0" x 12'-0" on center.
    b. Provide vertical struts at locations not more than 6'-0" from each perimeter wall and at the edge of vertical ceiling offsets.

E. Hanger and Bracing Wire Fastening:
1. Fasten hanger wires with not less than 3 tight turns.
2. Fasten bracing wires with 4 tight turns.
3. Make all tight turns within a distance of 1-1/2 inches.
4. Install hanger or bracing wire anchors to the structure in such a manner that the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire.

F. Hanger and Bracing Wire Separation: Separate all ceiling hanging and bracing wires at least 6 inches from all unbraced ducts, pipes, conduit, etc. It is acceptable to attach lightweight items, such as single electrical conduit not exceeding 3/4 inches nominal diameter, to hanger wires using connectors acceptable to DSA.

G. Light Fixtures:
1. Attach all light fixtures to the ceiling grid runners to resist a horizontal force equal to the weight of the fixtures.
2. Flush or recessed light fixtures and air terminals or services weighing **less than 56 pounds** may be supported directly on the runners of heavy-duty grid system but, in addition, shall have a minimum of two 12 gauge slack safety wires attached to fixture at diagonal corners and anchored to structure above. All 4'-0" x 4'-0" light fixtures shall have slack safety wires at each corner.
3. All flush or recessed light fixtures and air terminals or services weighing **56 pounds or more** shall be independently supported by not less than 4 taut 12 gauge wires each attached to fixture and to structure above regardless of the type of ceiling grid system used. The four taut 12 gauge wires, including their attachment to the structure, above shall be capable of supporting four times weight of the unit.

4. Support surface mounted light fixtures by at least 2 positive devices which surround the ceiling runner and which are each supported from structure above by a 12 gauge wire. Spring clips or clamps that connect only to the runner are not acceptable. Provide additional supports when light fixtures are 8'-0" or longer.

5. Support pendant mounted light fixtures directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting four times the weight of the fixture.

H. Wall Angles:

1. Install wall angles and edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
2. Screw attach moldings to substrate at intervals not over 16" on center and not more than 3" from ends.
3. Leveling with ceiling suspension system to tolerance of 1/8" in 12'-0".
4. Miter corners accurately and connect securely.

3.4 ACOUSTICAL CEILING PANEL INSTALLATION

A. Arrange acoustical units and orient directionally-patterned units with pattern running in one direction.

3.5 CLEANING UP

A. In addition to other stipulated requirements for cleaning, completely remove finger prints and traces of soil from the surfaces of grid and acoustical materials, using only those cleaning materials recommended for the purpose by the manufacturer of the material being cleaned.

B. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5100

SECTION 09 6110 - MOISTURE CONTROL TREATMENT FOR FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under a cash allowance, provide moisture control treatment applied over new or existing interior concrete slabs where resilient flooring, carpeting, or epoxy marble chip flooring are indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.
2. The Owner's independent testing laboratory shall conduct vapor emission, relative humidity, and pH testing before application of the moisture control treatment as specified herein.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 01 2100: Cash allowances.
3. Section 03 3300: Cast-in-place concrete floor slabs.
4. Section 09 0560: Common work results for flooring preparation; pH, relative humidity, and vapor emission testing.
5. Section 09 6500: Resilient flooring.
6. Section 09 6710: Epoxy marble chip flooring.
7. Section 09 6800: Carpeting.

1.2 ALLOWANCES

A. Cash Allowance for Moisture Control for Flooring: The Work of this Section is included in the cost of the moisture control treatment cash allowance specified in Section 01 2100.

1.3 DEFINITIONS

A. As used in this Section, "pounds" shall be defined as "pounds of water per 1,000 square feet per 24 hour period" as described in ASTM E907 and F1869.

B. Alkalinity shall be expressed as a "pH range of 1-14" as described in ASTM F710.

1.4 SYSTEM DESCRIPTION

A. Moisture control treatment shall form adhesion to damp, dry and wet concrete surfaces to restrict water vapor emission levels to a maximum of 3.0 pounds and allow adhesion to alkaline environments.

B. Moisture control treatment shall be compatible with all types of floor covering products and systems.

C. Application includes:
1. Concrete preparation
2. Moisture control treatment, minimum of 2 coats.
3. Cementitious top coat under carpet and resilient flooring.

1.5 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.

1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.
3. Installer Certification: Submit wet signature certification from manufacturer certifying that Installer is approved by manufacturer for installation of specified system for this project and is certified to install each component of the specified system.
4. Certified Testing: Submit manufacturers ASTM performance testing completed within 3 years of project application per ASTM E96, ASTM D1308, and ASTM D4541.
5. Warranty: Submit a copy of the actual warranty which will be issued for the Work; a sample warranty will not be acceptable. Submit full disclosure of all warranty exclusions and conditions. When warranty exclusions and conditions are not written on the actual warranty document, submit separate endorsement.

B. Contract Closeout Submittals: Comply with requirements of Section 01 7700.
1. Special Warranty: In addition to the warranty requirements of the Contract Documents, provide manufacturer’s 10-year labor and material warranty.
2. Installer Certification: Provide certification signed by the system installer and countersigned by the system manufacturer certifying that the moisture control treatment was installed in accordance with the Contract Documents and the manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Manufacturer: Firm regularly engaged in manufacture of moisture control treatment.

B. Installer: Company specializing in application of moisture control treatment, trained by the manufacturer of the products, and certified to install each component of the specified system.
1. Provide references including project name and location, telephone number and name of Owner and General Contractor, size of project, and date of completion.
2. Evidence of success shall include project pictures and pH and calcium chloride test results performed by an independent testing laboratory after installation of the system.

C. Environmental Requirements: Material and equipment shall comply with current regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).

1.7 PREINSTALLATION MEETING

A. Conduct preinstallation meeting to verify project requirements, substrate conditions, manufacturer’s installation instructions, and manufacturer’s warranty requirements.

1.8 SPECIAL WARRANTY

A. In addition to the warranty requirements of the Contract Documents, provide a 10-year labor and material warranty, non-prorated.

B. Application of product shall yield water vapor emission, relative humidity, and an alkalinity rate less than flooring manufacturer tolerances during the warranty period.

C. The manufacturer shall warrant the moisture control treatment against failure due to alkalinity and/or moisture emanating from the concrete. Warranty shall cover labor and material for repair or replacement of treatment, floor coverings or resinous materials, adhesives and patching compounds damaged by moisture, alkalinity, or improper system application at no cost to Owner.

E. Warranty shall not exclude concrete shrinkage cracks after application, non-compatibility with specified admixtures, concrete silicates or resin treatments, or ACI 318 or ACI 201 limitations.

F. Warranty shall be extended to future flooring updates or changes a cementitious topcoat is applied. Moisture control treatment manufacture shall provide written acceptance of the flooring change.

PART 2 - PRODUCTS

2.1 MOISTURE CONTROL TREATMENT

A. Moisture Control Treatment: Manufacturer's formulation of chemicals and resins mechanically restricting water vapor emission up to 95%, capillary action of up to 25.0 lbs., alkaline resistant; and capable of application on damp, dry and wet concrete substrates; crack treatment; minimum thickness recommended by the manufacturer.
1. Synthetic30fs by Synthetics International, (866) 646-0356.
2. Diamond-VRS by Diamond Stone Products, LLP, (888) 817-8663.
3. Vapor-Guard DC by Advanced Moisture Control, (949) 788-1490.
4. VAP I 2000 by Koester American Corporation, (757) 425-1206.
5. Substitutions: Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Physical Characteristics:
1. ASTM E96 Water Vapor Transmission, wet method: 0.60 US perms.
2. ASTM D4541 Concrete Adhesion: 600 psi (100% concrete cohesive failure).
3. ASTM D1308 Acid/Alkali Resistance: 14pH solution - 100% Resistant.
4. ASTM F1869 Calcium Chloride Testing: 3.0 pounds per 1,000 square feet or less.

2.2 CEMENTITIOUS TOP COAT

A. Self-leveling, Portland cement based coating, minimum 4,000 psi at 28 days, as recommended by moisture control treatment manufacturer to provide a smooth flooring substrate.

PART 3 - EXECUTION

3.1 VAPOR EMISSIONS, RELATIVE HUMIDITY, AND ALKALINITY PRE-TESTING

A. The Owner’s independent testing shall provide testing materials and conduct vapor emissions, relative humidity, and pH (alkalinity) testing in accordance with Section 09 0560.

B. On the basis of testing results, and at the Owner's direction, proceed with the work of this Section under Section 01 2100 - Cash Allowances.

3.2 SURFACE PREPARATION

A. Slab surfaces shall be solid, free from loose particles, cracks, pits rough projections, and foreign matter detrimental to the vapor emissions and alkalinity control system.

B. Cracks, joints, low spots, and high spots shall be prepared as recommended by the system manufacturer.

C. Shot blast concrete surfaces to remove surface contaminates, curing products, and hard dense non-porous layers to an ICRI#3 (100 grit) texture. Grind near walls and edges by industrial grinder with vacuum connection. Vacuum and remove dust, sand and debris.

D. Vacuum, blow and remove dust, sand and debris from slab surface and joints.

3.3 MOISTURE CONTROL TREATEMENT INSTALLATION

A. Joint and Crack Treatment: Coat cracks and joints. Apply manufacturer approved crack and joint compound in accordance with manufacturer's installation instructions.

B. Apply moisture control treatment product over entire surface to produce maximum penetration, alkalinity resistance and specified vapor reduction level in accordance with the manufacturer's written instructions. Coverage rate shall be as recommended by the manufacturer.

C. Cementitious Topcoat: Apply at a rate of up to 1/8" thickness to promote flooring adhesion using a non-porous primer. Primer shall be capable of securing product to moisture control treatment surface.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Manufacturer's representative shall visit the construction site for:
   1. Preinstallation meeting; and
   2. During installation to inspect product installation for compliance with the manufacturer's instructions.

3.5 PROTECTION

A. Protect the finished installation from damage.

B. Repair damage to moisture control treatment surfaces prior to installation of finished flooring.

END OF SECTION 09 6110

SECTION 09 6500 - RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide resilient flooring, base, and accessories where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
1. Section 09 0560: Floor preparation and moisture testing.
2. Section 09 6110: Moisture control treatment (contract allowance).

C. Special Coordination Requirements: Coordinate finish flooring manufacturer's concrete slab requirements with the work of Section 03 3000 - Cast-in-Place Concrete.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturers recommended installation procedures.
3. Samples: Submit 4 samples of each resilient flooring product specified on the Finish Schedule (including rubber transition strips).

B. Contract Closeout Submittals: Comply with requirements of Section 01 7700.
1. Manufacturer's recommended cleaning procedures.

1.3 QUALITY ASSURANCE

A. Fire Test Performance: Provide resilient flooring which complies with the following fire test performance criteria as determined by an independent testing laboratory acceptable to authorities having jurisdiction.
1. Critical Radiant Flux (CRF): Not less 0.45 watts / sq. cm.; ASTM E648.
2. Flame Spread: Not more than 75 per ASTM E84.
3. Smoke Developed: Not more than 450 per ASTM E84.
4. Smoke Density: Not more than 450 per ASTM E662.

B. Colors: Provide finish selections indicated in the Finish Schedule.
1. Acceptable Manufacturers: The products and manufacturers specified in the Finish Schedule are for purposes of establishing color and quality. Refer to each Specification Section for additional manufacturers and Section 01 2500 for substitution requirements.
2. Manufacturer’s Standard Colors and Finishes: Where Finish Schedule specifies a manufacturer’s standard color or finish, the Architect makes no guarantee that matching colors or finishes are available as other manufacturer’s “standard colors” from the listing of acceptable manufacturers. The Contractor shall be responsible for providing colors matching those indicated on the Drawings.
3. Custom Colors: Where Finish Schedule indicates a specific manufacturer’s colors, other acceptable manufacturers shall provide matching custom colors where a standard color is not acceptable.

1.4 EXTRA MATERIALS

A. Materials: Provide for the Owner's use, an extra stock of materials as follows:
   1. Tile Products: Provide an extra stock of approximately 5% of each type, color, pattern, and size of material installed.
   2. Base, Edge, and Stair Tread/Nosings: Provide an extra stock of approximately 5% of each type, color, and size of material installed.
   3. Package separately, distinctly marked, and protected against deterioration and damage.

B. Deliver materials to the Inspector of Record along with an inventory list of items provided. Obtain and forward to the Architect, a signed receipt from the Inspector accepting delivery.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Provide colors and patterns as selected by the Architect from standard colors and patterns of the approved manufacturer in the specified type.

C. Except as may be otherwise specified or approved by the Architect, provide resilient flooring **with coefficient of friction of 0.60** or higher; ASTM D2047.

D. High Performance Criteria: See Section 01 3560.

2.2 RESILIENT MATERIALS

A. Luxury Vinyl Tile:
   1. Dimension: 4" x 36" x 1/8".
   2. See Finish Schedule for types and patterns.
   3. Coefficient of friction greater than 0.5 per ASTM D2047.

2.3 RESILIENT ACCESSORIES

A. Resilient Base: ASTM F 1861, Type TS rubber, vulcanized thermoset; top set Style B cove, by Roppe.
   1. Size and color as shown on Drawings and Finish Schedule.
   2. Provide longest lengths possible for minimum splicing. Provide premolded corners at outside square corners, including base cabinet alcoves and outside corners.
   3. Provide continuous base around radius corners to a minimum of 6" before any splice.

B. Stair Tread and Nosing:
   1. Where shown on Drawings, provide square edge, service weight, rubber treads by Roppe continuous across opening.
   2. Provide visually-impaired marking at top and bottom treads.
   3. Color to as noted on drawings.

2.4 OTHER MATERIALS

A. Provide edge strips and 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. Adhesives: Provide waterproof and stabilized type adhesive as recommended by the manufacturer of the resilient materials; low-VOC.
   1. Allowable moisture limit of 90% internal relative humidity.
   2. Appropriate for the pH conditions of the substrate.

C. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
   3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109 or ASTM C472, whichever is appropriate.

D. Concrete Slab Primer: Provide non-staining type as required and as recommended by the manufacturer of the material being installed.

PART 3 - EXECUTION

3.1 EXAMINATION

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.

B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

C. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and Ph.
   1. Test in accordance with Section 09 0560.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
   3. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 0560.

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Concrete Subfloors:
   1. Verify that substrate is smooth, level, at required finish elevation, and without more than 1/8" in 10'-0" variation from level or slopes shown on the Drawings.
   2. Clean cracks, control joints, and other non-moving joints.
   3. Broom clean or vacuum the surfaces to be covered, and inspect the subfloors.
   4. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and

other irregularities with patching compound.
5. Seal patching compound with sealer recommended by the manufacturer and compatible with the flooring products specified.
6. Do not fill expansion joints, isolation joints, or other moving joints.
7. Prohibit traffic until patching compound is cured and sealed.

D. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.3 INSTALLATION

A. General:
1. Install materials only after finishing operations, including painting, have been completed and after permanent air conditioning system is operating.
2. Maintain reference markers, holes, and openings that are in place or plainly marked for future cutting by repeating on the finish surface as marked in the subfloor. Use chalk or other non-permanent marking device.
3. Inspect flooring materials to be installed. Defective materials will be subject to rejection and such rejection shall not be considered as grounds for additional compensation or time extension.

B. Starting installation constitutes acceptance of sub-floor conditions.

3.4 BASE INSTALLATION

A. Installation:
1. Install base where indicated on drawings.
2. Use factory-preformed exterior corners at square vertical outside corners only and factory-preformed or job-mitered interior corners.
3. Apply adhesive to insure contact not more than 1/4" from top of base.
4. Apply base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required.
5. Provide minimum length pieces of 12".
6. Take precautions to eliminate telegraphing of adhesive through the surface of installed base material.

3.5 CLEANING AND PROTECTING

A. Remove excess adhesive and other blemishes from exposed surfaces, using neutral cleaner recommended by the manufacturer of the resilient materials.

B. Resilient Tile:
1. Strip, seal, wax and buff finished flooring to a clean and uniform appearance as recommended by the manufacturer, using stripper and wax as approved by the Owner.
2. Provide the manufacturer's recommended number of coats of recommended sealer/wax on floor, then buff to a uniform appearance.

END OF SECTION 09 6500

SECTION 09 6710 - EPOXY MARBLE CHIP FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide heavy-duty industrial epoxy (vinyl cast) floor coating where shown on Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 03 3000: Cast-in-Place Concrete.
3. Section 09 0560: Floor preparation and moisture testing.
4. Section 09 6110: Moisture control treatment.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Samples: Submit 4 samples of each resilient flooring product specified on the Finish Schedule

B. Contract Closeout Submittals:
1. Manufacturer's recommended cleaning procedures.

1.3 QUALITY ASSURANCE

A. Applicator’s Qualifications: Ensure applicator’s qualifications by 1 of the following:
1. Use applicator experienced in application of specified materials for a minimum of 5 years on projects of similar size and complexity. Submit list of completed projects including project name and location, name of architect, name of material manufacturer, and approximate quantity of materials applied.
2. Submit letter of approval from manufacturer stating applicator is qualified to apply specified materials.

B. Applicator's Personnel: Employ persons trained for application of specified materials.

C. Preapplication Meeting: Convene a preapplication meeting before start of application of heavy-duty floor coating. Require attendance of parties directly affecting work of this section, including Contractor, Architect, applicator, and manufacturer's representative. Review surface preparation, application, curing, protection, and coordination with other work.

D. Fire Test Performance: Provide resilient flooring which complies with the following fire test performance criteria as determined by an independent testing laboratory acceptable to authorities having jurisdiction.
1. Critical Radiant Flux (CRF): Not less 0.45 watts / sq. cm.; ASTM E648.
2. Flame Spread: Not more than 75 per ASTM E84.
3. Smoke Developed: Not more than 450 per ASTM E84.
4. Smoke Density: Not more than 450 per ASTM E662.

E. Colors: Provide finish selections indicated in the Finish Schedule.
   1. Acceptable Manufacturers: The products and manufacturers specified in the Finish Schedule are for purposes of establishing color and quality. Refer to each Specification Section for additional manufacturers and Section 01 2500 for substitution requirements.
   2. Manufacturer's Standard Colors and Finishes: Where Finish Schedule specifies a manufacturer's standard color or finish, the Architect makes no guarantee that matching colors or finishes are available as other manufacturer's "standard colors" from the listing of acceptable manufacturers. The Contractor shall be responsible for providing colors matching those indicated on the Drawings.
   3. Custom Colors: Where Finish Schedule indicates a specific manufacturer's colors, other acceptable manufacturers shall provide matching custom colors where a standard color is not acceptable.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design: 8100 System OVERKRETE XTRA S Premium by Rust-Oleum Corporation, (847) 367-7700.
   1. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided request for substitution is submitted in accordance with Section 01 2500.

B. Heavy-Duty Floor Coating:
   1. Primer: Rust-Oleum Prime & Seal Primer; two-component, 100 percent solids, epoxy resin polymer.
   2. First Coat: Overkrete Xtra S Premium 100% solids epoxy coating, 12-14 mils thickness.
   3. Broadcast: Rust-Oleum Full Broadcast System Vinylcast (1/6") chips.
   4. Second Coat: Rust-Oleum 8100 System Overkrete Xtra S Premium 100% solids epoxy coating, 6-8 mils thickness.
   5. Finish Coat: Rust-Oleum 8100 System Overkrete Xtra OP Premium solids epoxy orange peel coating, 10-12 mils thickness.

C. Physical Characteristics:
   1. Two-component, high gloss, 100 percent solids, copolymer resin system; VOC compliant.
   2 Compressive Strength, ASTM C579: 7,900 psi.
   3. Flexural Strength, ASTM D790: 3,700 psi.
   4. Tensile Strength, ASTM D638: 3,900 psi.
   5. Taber Abrasion, ASTM D4060, 1,000 g Load, CS 17 Wheels: 30 mg loss per 1,000 cycles.
   6. Hardness, ASTM D2240, Shore D: 85.
   7. Vinylcast vinyl chip media.
   8. Color: Refer to Finish Schedule on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive heavy-duty floor coating. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

B. Determine moisture content of concrete slab in accordance with ASTM D4263, Rubber Manufacturers Association calcium chloride test, and manufacturer's instructions. Do not apply floor coating to concrete slab subject to osmotic pressure, hydrostatic pressure, or excessive water vapor emission.

C. Ensure new concrete has the following properties:
   1. Maximum water/cement ratio of 0.45.
   2. Cured a minimum of 10 days at a minimum of 70 degrees F.
   3. Minimum compressive strength of 3,500 psi.
   4. Minimum tensile strength of 200 psi.

3.2 SURFACE PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 0560.

B. Prepare surfaces in accordance with manufacturer's instructions.

C. Ensure concrete is clean and free of dirt, oil, grease, wax, paint, coatings, toppings, laitance, curing compounds, sealers, and other surface contaminants which will inhibit bonding of floor coating.

D. Repair cracked and eroded concrete in accordance with manufacturer's instructions. Remove and repair unsound concrete.

E. Provide abraded concrete surface texture similar to 60 grit sandpaper by acid etching, abrasive blasting, or mechanical preparation.
   1. If acid etching is performed, completely remove acid residue from concrete surface with a minimum 2,000 psi pressure water wash.
   2. If abrasive blasting or mechanical preparation is performed, completely remove concrete dust from concrete surface.

3.3 APPLICATION

A. Ensure concrete surface is visibly dry.

B. Mix component materials in accordance with manufacturer's instructions. Do not add thinners to materials.

C. Apply materials while air temperature is stable or decreasing.

D. Orange Peel (OP)
   1. First coat Primer (8 mils)
   2. Overkrete Xtra E-100 Base coat (12-14 mils)
   3. Full Broadcast system vinylcast chips (1/6" thick)
   4. Scrape off loose color chips
   5, Overkrete Xtra E-100s topcoat (6-8 mils)
   6. Overkrete Xtra OP Topcoat (10-12 mils)

E. For vertical surfaces use Overkrete Xtra E-100v in the same system as listed above

3.4 PROTECTION

A. Protect floor coating, when cured at temperatures between 65 and 90 degrees F:
   1. From Foot Traffic: Minimum of 24 hours.
   2. From Full Physical Use: Minimum of 72 hours.
   3. From Full Chemical Exposure: Minimum of 4 days.

END OF SECTION 09 6710

SECTION 09680 - CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide carpeting and carpet accessories as specified herein, and as needed for a complete and proper glue-down installation.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
1. Section 09 0560: Floor preparation and moisture testing.
2. Section 09 6110: Moisture control treatment.

C. Special Coordination Requirements: Coordinate finish flooring manufacturer's concrete slab requirements with the work of Section 03 3000 - Cast-in-Place Concrete.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Submit 3 copies of flammability rating for each type of carpet used.
3. Installation Procedures: Submit manufacturer's recommended installation procedures.
4. Samples: Submit 4 samples (12" x 12" each) of the carpets specified on the Finish Schedule.
5. Shop Drawings: Submit shop drawings showing location of seams and locations and types of carpet metal and accessories for Architect's approval.

B. Contract Closeout Submittals: Comply with requirements of Section 01 7700.
1. Manufacturer's recommended cleaning procedures.

1.3 QUALITY ASSURANCE

A. Flammability Rating: CBC Section 804.
1. Carpet Wainscot shall have a flame spread of 25 or less, Class A.
2. Flooring Carpet shall have a flame spread of 75 or less, Class B.
3. Minimum Critical Radiant Flux: Class II.

B. Accessibility: Provide glue-down or firm cushion installation that complies with CBC Section 11B-302.2.
1. Level loop, textured loop, level-cut, or level-cut/uncut pile texture and maximum pile height of ½".
2. Carpet edges shall comply with CBC Section 11B-303.

C. Colors: Provide finish selections indicated in the Finish Schedule.
1. Acceptable Manufacturers: The products and manufacturers specified in the Finish Schedule are for purposes of establishing color and quality. Refer to each Specification Section for additional manufacturers and Section 01 2500 for substitution requirements.
2. Manufacturer’s Standard Colors and Finishes: Where the Finish Schedule specifies a manufacturer’s standard color or finish, Architect makes no guarantee that matching colors or finishes are available as other manufacturer’s “standard colors” from the listing of acceptable manufacturers. The Contractor shall be responsible for providing colors matching those indicated on the Drawings.
3. Custom Colors: Where Finish Schedule indicates a specific manufacturer’s colors, other acceptable manufacturers shall provide matching custom colors where a standard color is not acceptable.

1.4 SPECIAL WARRANTY

A. Wear Warranty: Submit 3 original copies of the manufacturer's **10-year** Edge Ravel and Delamination Warranty, **10-year** Color Fastness Warranty and Wear Warranty. The warranties shall be dated, referenced to this project, and directed to the subcontractor and Contractor. They shall be signed by the carpet manufacturer, territorial representative, and the technical department head.

B. Special Project Warranty: In addition to the warranty requirements of the Contract Documents, submit 3 original copies of a special project warranty signed by the subcontractor/installer and the Contractor providing an extended correction period of **2 years**.

1.5 EXTRA MATERIALS

A. Materials: Provide for the Owner's use, an extra stock of approximately 2% of each type, color, and pattern of material installed and in addition, allow Owner to inspect and select from scrap carpet pieces remaining after installation. Bundle and wrap in burlap all extra material and Owner selected scraps.

B. Deliver materials to the Inspector of Record along with an inventory list of items provided. Obtain and forward to the Architect, a signed receipt from the Inspector accepting delivery.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01620.

2.2 CARPET

A. Provide carpets, colors as noted on Finish Schedule.

B. Provide all material from a single dye-lot.

2.3 RESILIENT ACCESSORIES

A. Refer to Resilient Flooring Specifications 09 6500 for Topset Rubber Base.

B. Rubber Edge Guards and Reducers: ASTM F2169, Type TS rubber, vulcanized thermoset; by Roppe.
   1. Provide edge or transition units in longest possible lengths.
   2. Color and style from manufacturers standard selections to be selected by Architect unless shown in Drawings.

2.4 OTHER MATERIALS

A. Adhesives: Provide waterproof and stabilized type adhesive as recommended by the manufacturer of the resilient materials; low-VOC.
   1. Allowable moisture limit of 90% internal relative humidity.
   2. Appropriate for the pH conditions of the substrate.

B. Provide seam adhesive as recommended by the manufacturer.

C. 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 SURFACE PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 0560.

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Immediately prior to installation of the work of this Section, thoroughly clean substrata and remove oil, grease, paint, varnish, hardeners, and other items which would adversely affect the bond of adhesive.

D. Make substrata level and free from irregularities. Assure one constant floor height after carpet is installed, filling low spots and grinding high spots as required.

3.3 CARPET INSTALLATION

A. General:
1. Glue directly to the floor, using no pads and no foam.
2. Scribe the carpet accurately to vertical surfaces.
3. Align the lines of carpet, as woven, using no fill strips, laying all carpet in the same direction unless specifically directed otherwise by the Architect.
4. Where carpeting is used on the walls, install as directed by the manufacturer, and trim all edges with a silver cap approved by the Architect.

B. Seams:
1. Locate seams only where shown on the approved Shop Drawings, or where specifically otherwise approved by the Architect.
2. Locate seams to the maximum extent practicable out of the way of traffic.
3. Fabricate seams by the compression method, using a butt joint, and properly bead and seal.
4. Do not stretch seams.

C. In addition to the cleaning requirements stated elsewhere, thoroughly clean carpet and adjacent surfaces prior to final acceptance of the carpeted areas by the Owner.

3.4 PROTECTION

A. Provide a heavy non-staining paper or plastic walkway as required over carpeting in direction of traffic, maintaining intact until carpeted space is accepted by the Owner.

END OF SECTION 09 6800

SECTION 09 7720 - VINYL-COVERED TACKBOARD PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide vinyl covered tackboard where shown on the drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Work: Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and sections in Division - 1 of these specifications.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Submit manufacturer's recommended installation procedures.
3. Samples: Submit 4 samples of each vinyl-covered tackboard specified on the Finish Schedule.

B. Contract Closeout Submittals: Manufacturer's recommended cleaning procedures.

1.3 QUALITY ASSURANCE

A. Provide each type of tackboard as produced by a single manufacturer including recommended primers, adhesives, and sealants.

B. Colors: Provide finish selections indicated in the Finish Schedule.
1. Acceptable Manufacturers: The products and manufacturers specified in the Finish Schedule are for purposes of establishing color and quality. Refer to each Specification Section for additional manufacturers and Section 01 2500 for substitution requirements.
2. Manufacturer’s Standard Colors and Finishes: Where the Finish Schedule specifies a manufacturer’s standard color or finish, the Architect makes no guarantee that matching colors or finishes are available as other manufacturer’s “standard colors” from the listing of acceptable manufacturers. The Contractor shall be responsible for providing colors matching those indicated on the Drawings.
3. Custom Patterns and Colors: Where the Finish Schedule indicates a specific manufacturer’s pattern and/or colors, other acceptable manufacturers shall provide matching custom colors where a standard color is not acceptable.

1.4 EXTRA MATERIALS

A. Materials: Provide for the Owner's use, an extra stock of approximately 10% of each type, color, and pattern of material installed with an appropriate amount of the proper adhesive. Package each type of material separately, distinctly marked, and protected against deterioration and damage.

B. Deliver materials to the Inspector of Record along with an inventory list of items provided. Obtain and forward to the Architect, a signed receipt from the Inspector accepting delivery.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable Manufacturers:
1. Koroseal, (888) 520-2810.
2. Global Products Tackboard by Western Building Materials, (559) 454-8500.
3. Lamvin Inc., (800) 446-6329.
4. Chatfield-Clarke, (714) 823-4297.
5. Nelson Adams (NACO), (909) 879-0421.
6. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Vinyl Covered Tackboard:
1. Vinyl Wall Covering:
a. Heavy duty (VWC-MD), Type II, total weight not less than 20 oz. per sq. yd., vinyl coating with Koroklear coating, fabric backing of osnaburg or drill.
b. Pattern/texture: Woven fabric look.
c. Color: As indicated on the Finish Schedule.
2. Panel Sizes: 1/2” thick; 8, 9 or 10 foot lengths (as required for minimum horizontal joints); depending on ceiling height; width of 48" minimum; cut panel size in any direction.

C. Flame Spread Characteristics: Provide materials bearing UL label and marking indicating fire hazard classification of wall covering as determined by ASTM E84 or UL 723. Provide materials with the following flame spread ratings:
1. Vinyl Covering: Class A; Flame spread of 25 or less, smoke-developed less than 450.

D. Accessory items:
1. Adhesives: Provide manufacturer's recommended adhesive, primer, and sealer, produced expressly for use with selected wall covering on substrate as shown on drawings. Provide materials which are mildew-resistant and non-staining.
2. Plastic Moldings and Trim: Provide moldings and trim around door and window frames and around all other building features which penetrate vinyl covered tackboard (such as fire extinguisher cabinets).
a. Plastic edge moldings shall be covered with factory applied veneer to match color and texture of vinyl wall covering.
b. Provide plastic moldings at the bottom of tackboard panels where shown in the detail drawings.
c. Provide manufacturers standard moldings for outside and inside corners and end caps at exposed edges.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine substrates and conditions under which work of this section will be performed. Correct conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Maintain constant minimum temperature of 60 degrees F (16 degrees C) at areas of installation for at least 72 hours before and 48 hours after application of materials.

B. Illuminate areas of installation using buildings' permanent lighting system; temporary lighting alone will not be acceptable.

C. Acclimatize board materials by removing from packaging in area of installation not less than 24 hours before application.

D. Remove switch plates, wall plates, and surface-mounted fixtures in areas where board is to be applied.

3.3 INSTALLATION

A. All vinyl wall covering shall be factory installed on 1/2" thick tackboard.

B. Corners of edge moldings around doors and windows shall be carefully cut at 45 degrees to provide tight fitting mitered corners. Sloppy corners will be not be permitted. Putty fill of gaps is not acceptable.

C. Provide metal edge moldings at outside corners.

D. Apply glue to backside of panels or to gypsum board in a uniform coat completely covering entire surface. Provide all temporary bracing required to ensure that vinyl covered tackboard is totally adhesive to gypsum board underlayment.

E. Cut the fiberboard backing, where required, so that the vinyl covering is left longer than the backing. Wrap the vinyl around the cut surface and glue. All finished panels shall have all edges wrapped.

F. Where vinyl covered tackboard is to be covered with rubber base, the maximum "gap" between concrete slab and tackboard shall be 3/8" the minimum "gap" shall be 1/8" (to prevent moisture from wicking up into tackboard). Provide non porous (metal or hardwood) backing for rubber base in resulting gap).

G. **Tackboard shall extend behind all blackboards and future cabinet work.** Tackboard **shall not** extend behind cabinet work that is part of this contract unless Drawings say otherwise.

H. Horizontal joints shall not be permitted unless indicated on the Drawings.

3.4 ADJUST AND CLEAN

A. Replace removed plates and fixtures; verify cut edges of wall coverings are completely concealed.

B. Remove surplus materials, rubbish, and debris resulting from wall covering installation upon completion of work, and leave areas of installation in neat, clean condition.

C. Remove and reglue any panels which show movement when "pushed" toward wall plain.

END OF SECTION 09 7720

SECTION 09 7730 - FIBERGLASS REINFORCED PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide fiberglass wall panels where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 09 9100: Priming of gypsum board and CMU surfaces.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's specifications and other data needed to prove compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.

B. Contract Closeout Submittals: Manufacturer's recommended cleaning procedures.

PART 2 - PRODUCTS

2.1 WALL PANELS

A. Textured Gloss Panels shall be finished panels 4' x 8' or 10' x 3/32" as required for installation with no horizontal seams, color as indicated on finish schedule. See Drawings for location.
1. Panels shall be solid fiberglass reinforced polyester construction. Class A; Flame spread of 25 or less, smoke-developed less than 450.
2. Adhesive shall be per manufacturer's standards, meeting requirements of ASTM C557-65T, non-toxic, non-flammable and per State Fire Marshal Standards.
3. Color: As noted on the Finish Schedule

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
1. Glasbord by Crane Composites, Inc.
2. FiberLite FRP - Wall Panels by Nudo.
4. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 OTHER MATERIALS

A. Provide manufacturer's standard prefinished vinyl clad moldings and trim in harmonizing colors at all joints, corners, and edges.

B. Adhesive: Titebond Fast Grab FRP Adhesive or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Securely install panels by adhering to substrate as recommended by the manufacturer. Set panels straight, plumb, level, and true to the lines and levels shown on the Drawings.

B. Install maximum length materials wherever possible.

C. Finish butt joints, wall juncture, wall/ceiling and wall/curb joints with the manufacturer's standard trim pieces and the specified sealant, tooling to a smooth finish.

D. When installed as a wainscot, position panels in a horizontal railroad style to minimize seams.

E. When indicated to be installed backside (smooth side) out, select panels free of mars and scratches.

3.2 CLEANING

A. Upon completion of each buildings work, remove all debris from building and site. Remove all excess mastic and caulking materials from finished surfaces and adjacent surfaces.

END OF SECTION 09 7730

SECTION 09 8435 - SOUND ABSORBING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide acoustic wall and/or ceiling panels as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 09 5100: Acoustical ceilings.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings showing location, direction, dimension, and connection of panels to substrates.

B. Contract Closeout Submittals: Manufacturer's recommended cleaning procedures.

1.3 EXTRA MATERIALS

A. Materials: Provide for the Owner's use, an extra stock of 2 full boxes of each type, color, pattern, and size of material installed. Package each type of material separately, distinctly marked, and protected against deterioration and damage.

B. Deliver materials to the Inspector of Record along with an inventory list of items provided. Obtain and forward to the Architect, a signed receipt from the Inspector accepting delivery.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable Products:
1. TECTUM Direct-Attach by Armstrong.
2. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Wall Panels:
1. 1" thick x 24" x full length units, mechanically fastened to horizontal blocking at 24" o.c. both sides, top and bottom, unless otherwise noted.
2. Class A; Flame spread of 25 or less, smoke-developed less than 450, per ASTM E84.
3. Plank weight not to exceed 1.65 P.S.F.
4. Color: White (TWH).

2.2 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 INSTALLATION, GENERAL

A. Wall Panels:
1. Install acoustic wall panels with long axis vertical and perpendicular to horizontal blocking at 24" o.c. Provide prepainted #10, 1-1/2" galv. self-tapping metal screws as detailed on the drawings.
2. Secure each full length panel with at least four screws minimum.
3. Screw heads shall be prepainted to match panel finish.

3.3 CLEANING

A. Remove all excess debris, trimmings and material upon completion of the work. Dispose of materials legally of the site.

END OF SECTION 09 8435

SECTION 09 9100 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. General: Paint and finish all 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.
   1. Surface preparation, priming, and painting specified in this Section are in addition to shop priming and surface treatment specified in other sections.
   2. Paint exposed surfaces whether or not colors are designated in schedules. Paint exposed surfaces to match adjacent materials or areas, in the color selected by the Architect.

B. Work Included: The following list is not totally inclusive and does not exclude work not stated herein but required to be painted in the specifications, Finish Schedule, and drawings. Unless otherwise specified, work to be painted under this Section includes, but is not limited to:
   1. Work specifically noted as requiring a paint finish in the drawings and specifications, and on the Finish Schedule.
   2. Priming of gypsum board and CMU substrates for fiberglass reinforced panels.
   3. Custom iron fences and gates.
   4. Concrete, sealer where indicated.
   5. Concrete masonry, where indicated.
   6. Exposed structural steel.
   7. Exposed metal decking.
   8. Interior and exterior metal fabrications, both galvanized and shop primed.
   9. Metal stairs.
   10. Wood trim.
   11. Wood casework.
   12. Interior and exterior ferrous metal.
   13. Interior and exterior galvanized metal.
   14. Galvanized flashings and sheet metal.
   15. Roof vents, fire vents, and roof accessories.
   16. Metal doors and frames.
   17. Wood doors.
   18. Cement plaster.
   19. Gypsum board.
   20. Acoustical ceilings/surfaces.
   21. FSK faced insulation exposed to view within rooms.
   22. Indoor gymnasium equipment.
   23. Outdoor recreation equipment.
   24. Exposed surfaces of glazing stops, including those visible after glazing is installed.
   25. Tubular daylighting device flashings, caps and curbs.
   26. Exposed mechanical items including:
      a. Piping, pipe hangers, and supports.
      b. Tanks.
      c. Ductwork and insulation.
      d. Mechanical equipment, and supports.
      e. Accessory items.
   27. Exposed electrical conduit, raceways, fittings, panels, and switchgear.

C. Work Not Included:
   1. Unless otherwise indicated, painting is not required on surfaces in concealed areas and inaccessible areas

such as furred spaces, foundation spaces, utility tunnels, pipe spaces, and duct shafts.
2. Surfaces of prefinished metals, anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require painting under this Section unless indicated on the Drawings.
3. Do not paint moving parts of operating units; mechanical or electrical parts such as valve operators; linkages; sensing devices; and motor shafts, unless otherwise indicated.
4. Do not paint over required labels or equipment identification, performance rating, name, or nomenclature plates.
5. Do not paint concrete which has been sandblasted unless specifically noted for painting.
6. Do not paint galvanized gratings.

D. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Priming or priming and finishing of certain surfaces may be specified to be factory-performed or installer-performed under pertinent other Sections.
3. Section 07 1900: Water repellant coatings.
4. Section 07 9210: Joint Sealants.
5. Section 09 9600: Painting of items with special paint coatings.
6. Section 32 1720: Painting for pavement markings.

E. Definitions: "Paint," as used herein, means coating systems materials including primers, emulsions, epoxy, enamels, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Samples: Following the selection of colors and glosses by the Architect, submit Samples for the Architect's review.
a. Provide four Samples of each color and each gloss for each material on which the finish is specified to be applied, approximately 8" x 10" in size.
b. Provide wood stain samples on specified wood for color selection or approval.
c. If so directed by Architect, submit Samples during progress of the Work in the form of actual application of the approved materials on actual surfaces to be painted.
d. Revise and resubmit each Sample as requested until the required gloss, color, and texture are achieved. Such Samples, when approved, will become standards of color and finish for accepting or rejecting the work of this Section.
e. Do not commence finish painting until approved Samples are on file at the job site.

B. Contract Closeout Submittals: Manufacturer's recommended cleaning procedures.

1.3 QUALITY ASSURANCE

A. 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.

B. Paint Coordination:
1. Provide finish coats which are compatible with the prime coats actually used and specified.
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.

1.4 DELIVERY, STORAGE, AND HANDLING

A. General:
1. Do not store flammable materials inside buildings.
2. Mix paint in a location and manner that will protect the environment and facilities.
3. Provide ventilation needed to comply with OSHA requirements.

1.5 SITE CONDITIONS

A. Do not apply exterior materials during fog, rain, or mist, or when inclement weather is expected within the dry time specified by the manufacturer. No exterior or interior painting shall be performed until the surfaces are thoroughly dry and cured. Do not apply paint when temperature is below 50°F. Avoid painting surfaces when exposed to direct sunlight.

1.6 EXTRA MATERIALS

A. Upon completion of the work of this Section, deliver to the Owner an extra stock equaling 5% of each color, type, and gloss of paint used in the Work, tightly sealing each container, and clearly labeling with contents and location where used.

B. Deliver materials to the Inspector of Record along with an inventory list of items provided. Obtain and forward to the Architect, a signed receipt from the Inspector accepting delivery.

PART 2 - PRODUCTS

2.1 PAINT MATERIALS

A. Products specified are for establishing the type, design, and quality required and are based on products of **Sherwin-Williams.** Other product systems approved for use are by Pittsburg Paints**,** Dunn-Edwards, and Frazee. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.
1. Where products are proposed other than Sherwin-Williams, submit a new painting schedule compiled in the same format used for the Painting Schedule included in this Section.
2. Approved specifications of materials for the other referenced manufacturers may be obtained from the Architect.

B. Undercoats and Thinners:
1. Provide undercoat paint produced by the same manufacturer as the finish coat, unless specified otherwise.
2. Use only the thinners recommended by the paint manufacturer, and use only to the recommended limits.
3. Provide undercoat, finish coat, and thinner material as parts of a unified system of paint finish.

C. Paint Systems: The specified standard is 100% acrylic premium top-of-the line paint, except where surfaces are specified to receive industrial coatings.

2.2 COLOR SCHEDULES

A. Refer to the Finish Schedule on the Drawings.

2.3 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 in accordance with all current Environmental Protection Agency standards and regulations.

2.4 JOINT SEALANTS

A. Provide in accordance with Section 07 9200.

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 MATERIALS PREPARATION

A. Mix, prepare, and store painting and finishing materials in accordance with the manufacturer’s written recommendations.

3.3 SURFACE PREPARATION

A. General:
1. Perform preparation and cleaning procedures in strict accordance with the paint manufacturers' recommendations.
2. Remove removable items which are in place and are not scheduled to receive paint finish.
3. Following completion of painting in each space or area, reinstall the removed items by using workmen who are skilled in the necessary trades.
4. Clean each surface to be painted prior to applying paint or surface treatment.
5. Remove dirt and other foreign substances. Remove oil and grease with clean cloths and cleaning solvent of low toxicity and flash point in excess of 200 degrees F, prior to start of mechanical cleaning.
6. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall onto wet newly painted surfaces.

B. Metal:
1. Thoroughly clean surfaces until free from dirt, oil, and grease per SSPC-SP 1. Remove all mill scale, rust formation, etc.
2. On galvanized surfaces, use solvent for the initial cleaning, and then treat the surface thoroughly with etching solution. Remove etching solution completely before proceeding. **Prime etched metals the same day cleaning was performed.** If any oxidation (white rust) has formed, sand and remove all forms of

contamination. If the galvanized has been passivated or stabilized, the surface must be abraded, i.e. Brush-Off Blast Clean per SSPC-SP7 or chemically treated.
3. Allow to dry thoroughly before application of paint.
4. Primers specified for structural steel and metal fabrications are standalone systems. Apply full paint system as specified in this Section even if metal comes preprimed or shop primed.

C. Prefinished Metal:
1. Solvent clean per SSPC-SP 1. Abrade substrate to remove gloss and obtain minimum surface profile of 1.0 mil. Solvent wipe to remove dust.

D. Concrete:
1. Thoroughly clean surfaces.
2. Prior to painting, the material shall be dry to the extent that a proper, long lasting, and non-blistering bond will be assured. Should the dryness of the substrate be in question, test the substrate in the presence of the paint manufacturer's representative. Do not paint substrate in question until dryness condition improves to meet the paint manufacturer's requirements.
3. Where floors are to be sealed, provide surface preparation per SSPC-SP13/NACE 6.

E. Masonry and Cement Plaster:
1. Allow to dry at least 30 days prior to cleaning in preparation for painting.
2. Remove glaze, efflorescence, laitance, surface deposits, and other foreign matter.

F. Gypsum Board: Remove all sanding dust.

G. Wood, Painted Finish:
1. Remove surface deposits of sap and pitch by scraping and cleaning with mineral spirits.
2. Seal all knots and pitch pockets with the paint manufacturer's recommended materials prior to prime coat.
3. Sand smooth all wood surfaces exposed to view, using the proper sandpaper and remove dust. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.
4. After prime coat is dry, fill cracks, holes, and scratches with suitable wood filler or spackling compound. When dry, sand flush with surface.
5. 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.

H. Wood, Stained Finish:
1. Apply paste wood filler to open grained wood prior to sanding.
2. Sand smooth all wood surfaces exposed to view, using the proper sandpaper and remove dust. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.
3. Apply wash coat of sealer, sand and remove dust.
4. Lightly sand and clean between finish coats as recommended by the paint manufacturer.
5. Seal tops, bottoms, and edges of cutouts on wood doors.

3.4 JOINT SEALANT

A. Refer to Section 07 9200.

B. Joint locations:
1. Intersection of interior painted wall / ceiling surface to door and window frames.
2. Intersection of exterior wall finish to door and window frames, color to match adjacent wall finish.
3. Intersection of painted wall / ceiling surface to dissimilar wall /ceiling surface (painted or unpainted).

3.5 PAINT APPLICATION

A. General:
   1. Touchup or reprime shop-applied prime coats which have been damaged, and touchup bare areas prior to start of finish coats application.
   2. 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.
   3. Sand and dust between coats to remove defects visible to the unaided eye from a distance of five feet.
   4. On removable panels and hinged panels, paint the back sides to match the exposed sides.
   5. Finish to be smooth.

B. Priming: Primers specified for structural steel and metal fabrications are standalone systems. Apply full paint system as specified in this Section even if metal comes preprimed or shop primed.

C. Drying: Allow sufficient drying time between coats, modifying the period as recommended by the material manufacturer to suit adverse weather conditions.

D. Brush Applications:
   1. Brush out and work the brush coats onto the surface in an even film.
   2. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.
   3. Ferrous and non-ferrous metals may be sprayed on first coat(s) but final coat shall be applied with brush or roller.

E. Spray Application:
   1. Except as specifically otherwise approved by the Architect, confine spray application to wall surfaces, large expanse areas 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.
   4. Ferrous and non-ferrous metals may be sprayed on first coat(s) but final coat shall be applied with brush or roller.

F. Roller Application:
   1. Apply paint with short nap roller on all metal doors. Color as specified (same interior and exterior).
   2. Remove all surface applied door trim prior to painting.
   3. Roller marks, lap marks, runs, sags, fuzz, lint or other surface imperfections will not be acceptable.
   4. Ferrous and non-ferrous metals may be sprayed on first coat(s) but final coat shall be applied with brush or roller.

G. 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.

H. Exposed Mechanical and Electrical Items:
   1. Finish electric panels, access doors, conduits, pipes, ducts, grilles, registers, vents, exposed plumbing vents and flues, and items of similar nature to match the adjacent wall and ceiling surfaces, or as directed.
   2. Paint visible duct surfaces behind vents, registers, and grilles flat black.
   3. Exposed vents and flues: Apply two coats of heat-resistant paint approved by the Architect.
   4. Factory finished items that match color scheme may be approved for leaving unpainted by Architect.

I. Exposed Pipe and Duct Insulation:

1. 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.
2. Match color of adjacent surfaces unless otherwise noted.
3. Remove band before painting, and replace after painting.

J. Hardware: Paint prime coated hardware to match adjacent surfaces, unless otherwise noted. 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.

K. Wet Areas:
1. In toilet rooms and contiguous areas, add an approved fungicide to paints.
2. For oil base paints, use 1% phenolmercuric or 4% tetrachlorophenol.
3. For water emulsion and glue size surfaces, use 4% sodium tetrachlorophenate.

L Miscellaneous:
1. Use "stipple" finish where enamel is specified.
2. Ferrous Metal: When metal comes shop primed or preprimed, always reprime with a solvent primer or Direct-to-Metal (DTM) primer. Sand or remove all visible rust.
3. **Wood Trim: Backprime exterior wood trim prior to installation with the paint manufacturer's recommended exterior wood primer.**
4. Touch-up shall be performed using the same application method as the original final coat application.

3.6 PROTECTION

A. Protect floors, furnishings, equipment, finish hardware, name or information plates, dials, gauges, tile, or other such surfaces not requiring painting from spotting, spillage, or damage of any kind. Clean, repair, or replace any damaged surfaces as directed by the Architect.

B. Remove, loosen, or mask hardware, fixture canopies, outlet covers, switch plates, and other similar items as required for painting work and then replace.

C. Using workmen skilled in these trades, move equipment adjacent to walls to permit wall surfaces to be painted, and following completion of painting, replace and reconnect.

3.7 CLEANING

A. Upon completion of all paint work, clean paint from all glass surfaces leaving a sharp clean line.

B. Remove paint spots, oil, or stains.

3.8 PAINTING SCHEDULE

A. General: Provide paint systems as specified below.
1. Products specified in this schedule are based upon products of **Sherwin-Williams** and are specified for establishing the type and quality of products required. Refer to Paragraph 2.1.A of this Section.
2. See Finish Schedule for colors and gloss.
3. Abbreviations: (F) = Flat, (LL) = Low Luster, (SGE) = Semi-Gloss Enamel; (ESE) = Eggshell Enamel; (GE) = Gloss Enamel; (SL) = Stain/Lacquer

B. Exterior Metal, Ferrous (SGE):
1. First coat: B66-310, Pro Cryl Universal Primer
2. Second coat: B66 Series DTM Semi-Gloss
3. Third coat: B66 Series DTM Semi-Gloss

C. Exterior Metal, Galvanized and Aluminum (SGE):
   1. First coat: B71Y1, DTM Wash Primer
   2. Second coat: B66 Series, DTM Semi-Gloss
   3. Third coat: B66 Series, DTM Semi-Gloss

D. Exterior Metal, Prefinished Aluminum (SGE):
   1. First coat: B5100150, Extreme Bonding Primer
   2. Second coat: B66 Series, DTM Semi-Gloss
   3. Third coat: B66 Series, DTM Semi-Gloss

E. Exterior Metal, Prefinished Ferrous (SGE):
   1. First coat: B5100150, Extreme Bonding Primer
   2. Second coat: B66-350, Sher-Cryl HPA Semi-Gloss
   3. Third coat: B66-350, Sher-Cryl HPA Semi-Gloss

F. Exterior Cement Plaster and Concrete (LL):
   1. First coat: A24W300, Loxon Masonry Primer
   2. Second coat: A6 Series, A100 Exterior Flat
   3. Third coat: A6 Series, A100 Exterior Flat

G. Exterior Concrete Block (F):
   1. First coat: B42W00150, PI Heavy Duty Block Filler
   2. Second Coat: A6 Series, A100 Exterior Flat
   3. Third coat: A6 Series, A100 Exterior Flat

H. Exterior Wood (F):
   1. First coat: B51W00620, Prep Rite ProBlock Latex Primer
   2. Second coat: A6 Series, A100 Exterior Flat
   3. Third coat: A6 Series, A100 Exterior Flat

I. Exterior Wood - Solid Color Stain (F):
   1. First coat: A15 Series, Woodscapes Exterior Acrylic Solid Color Stain
   2. Second coat: A15 Series, Woodscapes Exterior Acrylic Solid Color Stain

J. Interior Primer Only behind FRP or VWC:
   1. Gypsum Drywall: B51W00620, Prep Rite ProBlock Latex Primer
   2. Concrete Block: B42W00150, PI Heavy Duty Block Filler

K. Interior Flat Wall Paint (F):
   1. Gypsum Drywall:
      a. First coat: B28-2600, Pro Mar 200 Zero Primer
      b. Second coat: B30-3600, Pro Mar 200 Zero Flat
      c. Third coat: B30-3600, Pro Mar 200 Zero Flat
   2. Concrete Block:
      a. First coat: B42W00150, PI Heavy Duty Block Filler
      b. Second coat: B30-3600, Pro Mar 200 Zero Flat
      c. Third coat: B30-3600, Pro Mar 200 Zero Flat
   3. Acoustic Surfaces:
      a. First Coat: D16W00151 Cashmere
      b. Second Coat: D16W00151 Cashmere

L. Interior Egg-Shell Enamel (ESE):

1. Gypsum Drywall:
   a. First coat: B28-2600, Pro Mar 200 Zero Primer
   b. Second coat: B20-2600, Pro Mar 200 Zero EG
   c. Third coat: B20-2600, Pro Mar 200 Zero EG
2. Concrete Block:
   a. First coat: B42W46, Heavy Duty Block Filler
   b. Second coat: B20-2600, Pro Mar 200 Zero EG
   c. Third coat: B20-2600, Pro Mar 200 Zero EG
3. Cement Plaster:
   a. First coat: A24, Loxon Masonry Primer
   b. Second coat: B20-2600, Pro Mar 200 Zero EG
   c. Third coat: B20-2600, Pro Mar 200 Zero EG
4. Ferrous Metal:
   a. First coat: B66-310, Pro Cryl Universal Primer
   b. Second coat: B20-2600, Pro Mar 200 Zero EG
   c. Third coat: B20-2600, Pro Mar 200 Zero EG
5. Galvanized Metal:
   a. First coat: B71Y1, DTM Wash Primer
   b. Second coat: B20-2600, Pro Mar 200 Zero EG
   c. Third coat: B20-2600, Pro Mar 200 Zero EG

M. Interior Semi-Gloss Enamel (SGE):
1. Ferrous Metal:
   a. First coat: B66-310, Pro Cryl Universal Primer
   b. Second coat: B6601551, Multi-Surface Acrylic
   c. Third coat: B6601551, Multi-Surface Acrylic
   d. Note: Where trim paint is an extension of or same as exterior color, use the same paint specified under “Exterior Metals”.
2. Galvanized Metal:
   a. First coat: B71Y1, DTM Wash Primer
   b. Second coat: B6601551, Multi-Surface Acrylic
   c. Third coat: B6601551, Multi-Surface Acrylic
   d. Note: Where trim paint is an extension of or same as exterior color, use the same paint specified under “Exterior Metals”.
3. Wood Doors and Trim:
   a. First coat: B5100150, Extreme Bonding Primer
   b. Second coat: B6601551, Multi-Surface Acrylic
   c. Third coat: B6601551, Multi-Surface Acrylic
4. Prefinished Aluminum:
   a. First coat: B5100150, Extreme Bonding Primer
   b. Second coat: B6601551, Multi-Surface Acrylic
   c. Third coat: B6601551, Multi-Surface Acrylic
5. Concrete Block:
   a. First coat: B42W46, Heavy Duty Block Filler
   b. Second coat: B31-2600, Pro Mar 200 Zero SG
   c. Third coat: B31-2600, Pro Mar 200 Zero SG
6. Gypsum Drywall:
   a. First coat: B28-2600, Pro Mar 200 Zero Primer
   b. Second coat: B31-2600, Pro Mar 200 Zero SG
   c. Third coat: B31-2600, Pro Mar 200 Zero SG

N. Interior Gloss Enamel (GE):
1. Ferrous Metal:

a. First coat: B66-310, Pro Cryl Universal Primer
b. Second coat: B21W351, Pro Classic Waterborne Interior Gloss Enamel
c. Third coat: B21W351, Pro Classic Waterborne Interior Gloss Enamel

2. Galvanized Metal:
   a. First coat: B71Y1, DTM Wash Primer
   b. Second coat: B21W351, Pro Classic Waterborne Interior Gloss Enamel
   c. Third coat: B21W351, Pro Classic Waterborne Interior Gloss Enamel
   d. Note: Where trim paint is an extension of or same as exterior color, use the same paint specified under “Exterior Metals”.
3. Wood Doors and Trim:
   a. First coat: B5100150, Extreme Bonding Primer
   b. Second coat: B21W351, Pro Classic Waterborne Interior Gloss Enamel
   c. Third coat: B21W351, Pro Classic Waterborne Interior Gloss Enamel
4. Concrete Block:
   a. First coat: B42W46, Heavy Duty Block Filler
   b. Second coat: B21W351, Pro Classic Waterborne Interior Gloss Enamel
   c. Third coat: B21W351, Pro Classic Waterborne Interior Gloss Enamel
5. Gypsum Drywall:
   a. First coat: B5100150, Extreme Bonding Primer
   b. Second coat: B21W351, Pro Classic Waterborne Interior Gloss Enamel
   c. Third coat: B21W351, Pro Classic Waterborne Interior Gloss Enamel

O. Stain and Lacquer (SL):
1. Wood Doors and Trim (transparent):
   a. Stain: A49 Series, Wood Classics Oil Stain
   b. First coat: B44MJ91, Lacquer Sealer
   c. Second coat: B44FJ86, Semi-Gloss Lacquer
   d. Third coat: B44FJ86, Semi-Gloss Lacquer
2. Wood Trim (opaque):
   a. First coat: A15 Series, Woodscapes Acrylic Solid Color Stain
   b. Second coat: A15 Series, Woodscapes Acrylic Solid Color Stain

P. Acoustic Surfaces:
1. First Coat: D16W00151 Cashmere
2. Second Coat: D16W00151 Cashmere

Q. Exposed (Sealed) Concrete Floors:
1. General Polymers clear floor coating and resinous flooring.
2. Epoxy Flooring: SW Armorseal 8100.

R. Exterior Masonry Walls – Water Repellent:
1. Water repellent in accordance with specification section 07 1900.

S. Exterior Masonry Walls – Anti-Graffiti Coating:
1. “Monochem Permashield Non-Sacrificial Graffiti Resistant Coating” in accordance with the manufacturer’s recommendations.

END OF SECTION 09 9100

SECTION 10 1115 - MARKER BOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide markerboards where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
   1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
   2. Installation Procedures: Submit manufacturer's recommended installation procedures.

B. Contract Closeout Submittals: Manufacturer's recommended cleaning procedures.

PART 2 - PRODUCTS

2.1 MARKER BOARDS

A. Liquid marker boards, porcelain enamel-coated 24 gage steel writing surface on 1/2" industrial grade particle board with moisture retardant barrier back sheet.
   1. Clear anodized aluminum trim with wrapped and mitered corners.
   2. Box style marker trough with end caps, 2" high map rail with black cork insert, map hooks (1 for every 2 linear feet), and one flag standard per room.
   3. Size: As indicated on Drawings and **continuous up to 16' wide without joints**.
   4. Low gloss, glare free, multi-media writing and projection surface.
   5. All marker boards shall be magnetic.

B. Acceptable Products:
   1. Series 10-150 by Aarco Products Inc., (800) 246-6038.
   2. 202 Series by MooreCo, Inc., (800) 749-2258.
   3. Series 4 by Claridge Products and Equipment, Inc., (800) 434-4610.
   4. BTS Series by Platinum Visual Systems, (800) 498-2990.
   5. Series A-B1 by ADP Lemco, Inc., (800) 575-3626.
   6. Series 2000, By Nelson Adams (NACO) 909-879-0421.

2.2 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. Provide one box of 12 assorted colored markers for each markerboard, and one eraser set for each 12 foot length of markerboard or portion thereof.

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 INSTALLATION

A. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, and the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position for long life under hard use.

END OF SECTION 10 1115

SECTION 10 1400 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide identifying devices where shown on the Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:

1. Restroom signage.
2. Room identification signage (room name, room number).
3. Tactile exit signage.
4. Room occupancy signage.
5. Accessibility signage.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 10 1410: Project plaque.
3. Section 10 1420: Dimensional letter signage.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings showing details of installation and anchorage sufficient to enable proper interface with the work of other trades.
4. Samples:
   a. Provide color chip samples to match colors specified.
   b. Provide sample of sign for example of quality and design characteristics.

1.3 QUALITY CONTROL

A. Code References:
1. Raised Characters: 11B-703.2.
2. Braille: Section 11B-703.3.
3. Visual Characters: Section 11B-703.5.
4. Pictograms: Section 11B-703.6.
5. Symbols of Accessibility: Section 11B-703.7.
6. International Symbol of Accessibility: Section 11B-703.7.2.1.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Acceptable Products: Design of plexiglass signs is based on the use of manufacturer's standard products: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
   1. ASI Sign Systems.
   2. Inland Pacific.
   3. Innerface Architectural Signage, Inc.
   4. Mohawk Sign Systems.
   5. Vomar Products, Inc.
   6. Best Signs, Inc.

2.2 SIGNS

A. **Type "A" - Restroom Signs**:
   1. Type A1: MEN - 12" equilateral triangle.
   2. Type A2: WOMEN - 12" diameter circle.
   3. Type A3: UNISEX - 12" diameter circle with equilateral triangle inscribed. Triangle color shall contrast with circle color. Circle color shall contrast with door color.
   4. Type A4: Restroom, with raised wheelchair logo, 3/4" high raised text and braille.
      a. Braille: Contracted (Grade 2) braille symbols on sign A4 per CBC Section 11B-703.3.
   5. Material:
      a. Types A1, A2, and A3: 1/4" thick acrylic plastic, 1/4" radius corners.
      b. Type A4: 1/8" acrylic plastic base plaque, integral color (single piece, not laminated), 1/4" radius corners, 1/32" raised letters and numbers.
   6. Color: Black with white silk screened lettering and graphic, see detail.
   7. Attachment: Epoxy and vandal resistant screws.
   8. Text: See graphics/text detail on the drawings.
   9. Letter Style: Calibri, all capital letters.

B. **Type "B" - Room Name, Room Number, or Tactile Exit Signs:**
   1. Type B1: 4"H x Length as Required (LAR).
   2. Type B2: 4"H x LAR.
   3. Type B3: 5-1/2"H x LAR.
   4. Type B4: 4"H x LAR, text: "EXIT"
   5. Material: 1/8" acrylic plastic base plaque, integral color (single piece, not laminated), 1/4" radius corners, 1/32" raised letters and numbers.
   6. Color: Black with white lettering.
   7. Attachment:
      a. Exterior: Epoxy and minimum of 2 vandal resistant screws
      b. Interior: Epoxy
   8. Letter style: Calibri, all capital letters.
   9. Text: Refer to the Door Schedule and related details on the Drawings.
   10. Numeral height: 2".
   11. Letter height: 1". Except at access doors for automatic sprinkler riser rooms and fire pump rooms which require 2" minimum height with a minimum stroke of 3/8".
   12. Braille: Contracted (Grade 2) braille symbols on all room name and number signs per Section 11B-703.3.

C. **Type "C" - Building Access Sign:**
   1. Material: 1/8" acrylic plastic base plaque, integral color (single piece, not laminated), 1/4" radius corners, 1/32" raised letters and numbers.
   2. Color: International Blue with white International Symbol of Accessibility logo.
   3. Attachment: Epoxy with vandal resistant screws.
   4. Size: 8" x 8"
   5. Braille: Contracted (Grade 2) braille notation per CBC Section 11B-703.3.

D. **Type "D" - Room Occupancy Signs:**
1. Size: 12" x Height as required.
2. Material: 1/8" acrylic plastic base plaque, integral color (single piece, not laminated), 1/4" radius corners, 1/32" raised letters and numbers.
3. Color: Black with white letters
4. Attachment: Double stick tape four edges with 4 vandal resistant screws.
5. Letter style: Calibri, all capital letters.
6. Letter size: As required by the State Fire Marshal.
7. Text: As indicated on the Drawings.

E. **Type "E" - Platform Lift Sign:**
1. Size: 9" x 9".
2. Material: 1/8" acrylic plastic base plaque, integral color (single piece, not laminated), 1/4" radius corners, 1/32" raised letters and numbers.
3. Color: International Blue with white symbols and text.
4. Attachment: Double stick tape four edges with 4 vandal resistant screws.
5. Letter style: Calibri, all capital letters.
6. Letter size: 5/8".
7. Text: As indicated on the Drawings.
8. Braille: Contracted (Grade 2) braille symbols per CBC Section 11B-703.3.

F. **Type "F" - Listening Assistance Sign:**
1. Size: 10" x 8".
2. Material: 1/8" acrylic plastic base plaque, integral color (single piece, not laminated), 1/4" radius corners, 1/32" raised letters and numbers.
3. Color: International Blue with white symbols and text.
4. Attachment: Double stick tape four edges with 4 vandal resistant screws.
5. Letter style: Calibri, all capital letters.
6. Letter height: 5/8".
7. Text: As indicated on the Drawings.

2.3 BRAILLE REQUIREMENTS

A. Braille Symbols:
1. Contracted (Grade 2) braille.
2. Braille Dots:
a. Base diameter: 0.059” to 0.063”.
b. Distance between two dots in the same cell: 0.100”.
c. Distance between corresponding dots in adjacent cells: 0.300”.
d. Raise dots 0.025” to 0.037” above the background.
e. Distance between corresponding dots from one cell directly below: 0.395” to 0.400”.
f. Dots shall have domed or rounded tops.

2.4 TACTILE CHARACTER REQUIREMENTS

A. Raised Character Proportions per CBC Section 11B-703.2.4 and 11B-703.2.6:
1. Width of upper-case letter "O" shall be a minimum of 60% and a maximum of 110% of the height of the upper-case letter "I".
2. Stroke thickness of upper-case letter "I" shall be 15% maximum of the height of the character.

B. Visual Character Proportions per CBC Section 11B-703.5.4 and 11B-703.5.7:
1. Width of upper-case letter "O" shall be a minimum of 60% and a maximum of 110% of the height of the

upper-case letter "I".

2. Stroke thickness of upper-case letter "I" shall be a minimum of 10% and a maximum of 20% maximum of the height of the character.

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 INSTALLATION

A. Install the work of this Section in strict accordance with the manufacturers' recommendations as approved by the Architect, using only the approved mounting materials, and locating all components firmly into position, level and plumb.

B. Mounting Location and Height. Install signs on the nearest wall adjacent to the latch side of the door. Where there is no wall or space on the latch side, including at double doors, place signs on the nearest adjacent wall, preferably on the right.
   1. Mount signs 48" minimum above the finish floor or ground surface, measured from the baseline of the lowest line of Braille and 60" maximum above the finish floor or ground surface measured from the baseline of the highest line of raised characters.
   2. Determine mounting location such that a person may approach within 3" of signage without encountering protruding objects or standing within the swing of the door.

C. At locations where an exit sign and a room identification sign are back to back on glass, align both signs and make signs the same size.

D. At locations where a sign is mounted on glass with no opposing sign, provide blank sign of the same size to conceal mounting adhesive.

E. Where signs are mounted on split-faced masonry, grind masonry to provide smooth surface to mount signs.

END OF SECTION 10 1400

SECTION 10 1410 - PLAQUES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide project plaque where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 10 1400: Signage.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings showing details of installation and anchorage sufficient to enable proper interface with the work of other trades.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500

B. Design is based on use of standard products manufactured by:
a. Ark Ramos.
b. Metal Arts.

2.2 BUILDING PLAQUE

A. Provide and install a building plaque with the following attributes:
1. Plaque size: 18" x 24" bronze
2. Letter sizes: To be determined.
3. Letter style: Calibri.
4. Type border: Flat band edge (Metal Arts designation).
5. Field texture: Leatherette.
6. Color/Finish: Black oxidized field, satin polished letter faces and border, 2 coats clear metal lacquer.
7. Type mounting: Concealed.
8. Text: To be determined, allow for 300 letters and numerals.

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 INSTALLATION

A. Install the work of this Section in strict accordance with the manufacturers' recommendations as approved by the Architect, using only the approved mounting materials, and locating all components firmly into position, level and plumb.

END OF SECTION 10 1410

SECTION 10 1420 - DIMENSIONAL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide dimensional signage where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 10 1400: Signage.
3. Section 10 1410: Project plaque.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings showing details of installation and anchorage sufficient to enable proper interface with the work of other trades.
4. Samples:
a. Provide color chip samples to match colors specified.
b. Provide sample of signage for example of quality and design characteristics.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Acceptable Products: Design of solid letters is based on the use of manufacturer’s standard products: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
1. Metal Arts.

2.2 SOLID LETTERS

A. Solid Letters:
1. Letter style: Helvetica Medium, "CAPS"
2. Vertical height: As indicated on the Drawings.
3. Material: 1" deep, cast aluminum, with 2 coats baked-on acrylic urethane enamel.
4. Text: As indicated on the Drawings.
5. Color: As selected by the Architect from the manufacturer's standard colors.
6. Attachment: Concealed with mechanical anchors with epoxy adhesive.

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 INSTALLATION

A. Install the work of this Section in strict accordance with the manufacturers' recommendations as approved by the Architect, using only the approved mounting materials, and locating all components firmly into position, level and plumb.

B. Mounting Location. Install dimensional signage where indicated on the Drawings.

END OF SECTION 10 1420

SECTION 10 2125 – SOLID PLASTIC TOILET PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide floor anchored, overhead braced, solid plastic toilet partitions and wall mounted urinal screens where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 05 5000: Metal Fabrications.
3. Section 06 1000: Rough Carpentry.
2. Section 10 2810: Toilet accessories and grab bars.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with adjacent trades.
4. Color Charts: Submit 4 color charts or samples showing colors selected by the Architect.
5. Manufacturer’s Certificates: Certify products meet or exceed specified requirements.

B. Contract Closeout Submittals: Manufacturer's recommended cleaning procedures.

1.3 QUALITY ASSURANCE

A. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.

B. Colors: Provide finish selections indicated in the Finish Schedule.
1. Acceptable Manufacturers: The products and manufacturers specified in the Finish Schedule are for purposes of establishing color and quality. Refer to each Specification Section for additional manufacturers and Section 01 6200 for substitution requirements.
2. Manufacturer’s Standard Colors and Finishes: Where the Finish Schedule specifies a manufacturer’s standard color or finish, the Architect makes no guarantee that matching colors or finishes are available as other manufacturer’s “standard colors” from the listing of acceptable manufacturers. The Contractor shall be responsible for providing colors matching those indicated on the Drawings.
3. Custom Colors: Where the Finish Schedule indicates a specific manufacturer’s colors, other acceptable manufacturers shall provide matching custom colors where a standard color is not acceptable.

C. Performance Requirements:
1. Graffiti Resistance: Partition material shall have the following graffiti removal characteristics when tested in accordance with ASTM D6578-00 Standard Practice for Determination of Graffiti Resistance in accordance with Section 9, “Graffiti Removal Procedure Using Manual Solvent Rubs”:
a. Cleanability: Five (5) required staining agents shall be cleaned off material.
2. Scratch Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D2197-98(2002) Standard Test Method for Adhesion of Organic Coating by Scrape Adhesion, using Gardner Stock #PA-2197/ST pointed stylus attachment on scrape tester:

a. Scratch Resistance: Maximum Load Value shall exceed 10 kilograms.

3. Impact Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D2794-93(1999)e1 Standard Test Method for Resistance of Organic Coating to the Effects of Rapid Deformation (Impact), using .625" hemispherical indenter with 2-lb impact weight:
   a. Impact Resistance: Maximum Impact Force value shall exceed 30 inch-lbs.
4. Fire Resistance: Partition material shall comply with the following requirements, when tested in accordance with ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials:
   a. Smoke Developed Index: Not to exceed 450.
   b. Flame Spread Index: Not to exceed 75.
   c. Material Fire Ratings:
      i. National Fire Protection Association (NFPA): Class B.
      ii. International Code Council (ICC): Class B.

5. ASTM International (ASTM):
   a. ASTM A 666 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   b. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   c. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

6. National Fire Protection Association (NFPA):
   a. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

7. Manufacturer Qualifications: Five years or more experience in manufacture of laboratory casework and equipment of type specified.

8. Installer: Five years or more experience with installation of similar products, and acceptable to the manufacturer.

9. Mock-Up: Provide a mock-up for evaluation of fabrication techniques and application workmanship.
   a. Install in areas designated by Architect.
   b. Do not proceed with remaining work until installation is approved by Architect.

1.4 SPECIAL WARRANTY

A. In addition to the warranty requirements of the Contract Documents, submit 2 original copies of the manufacturer's written **25-year limited warranty** for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable Manufacturers:
   1. Scranton Products, which is located at: 801 E. Corey St.; Scranton, PA 18505; Toll Free Tel: 800-445-5148; Fax: 855-376-6161; Email:request info (info@scrantonproducts.com); Web:www.scrantonproducts.com
   2. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Provide floor-mounted, overhead braced, solid plastic, toilet partitions and urinal screens as indicated on the Drawings, in the dimensions and arrangements shown, and with the following attributes.
   1. Doors, Panels and Pilasters:
      a. High density polyethylene (HDPE), fabricated from polymer resins compounded under high pressure, forming single thickness panel.
      c. Waterproof and nonabsorbent, with self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instruments.
      d. Thickness: 1 inch with 1/4 inch radiused edges. One edge of pilaster and transom panels to be ship lapped.
   2. Aluminum and Aluminum Extrusions: ASTM B221, 6463-T5 alloy and temper.
   3. Stainless Steel: ASTM A167, Type 304.

2.2 Toilet Compartment System

A. Basis of Design: ARIA Toilet Partitions as manufactured by and supplied by Scranton Products.
   1. Style: Full height floor mounted overhead braced toilet compartments.

B. System Construction:
   1. System Specified Height 118”.
   2. Doors: 79 inches high. Mounted 1 inch above finished floor.
   3. Dividing Panels: Two panels stacked and secured with 3 dowels ensuring proper alignment totaling the system specified height
   4. Pilasters: System specified height, shoeless system secured with 3/4 inch long stainless steel tamper resistant Torx head screws and angled wall brackets.
   5. Transom Panel: Height required to accommodate specified system height with ship lap on one edge. Mounted with four mending plates using 3/4 inch long stainless steel tamper resistant Torx head screws.
   6. Wall Brackets: (82 inches) long, heavy-duty aluminum. Mounts to pilasters, panels and walls with 3/4 inch long stainless steel tamper resistant Torx head screws.

C. System Design:
   1. Door Design: Traditional Series; Model 2000.
   2. Side Panel Design: Plain.
   3. Color: As indicated in the finish schedule from Manufacturer's selection.
   4. Trim Color: As indicated in the finish schedule from Manufacturer's selection.

2.3 HARDWARE:

A. Hinges: Helix style 78 inches edge mounted continuous hinge.
   1. Stainless steel: 0.09 inch thick 304-2B stainless steel using a stainless-steel pin in 0.25 inch diameter.
   2. Closing degree is minus 5 degrees. Hinge is designed to come to a full close on its own weight.

B. Occupancy Indicator Latch and Housing: Satin stainless-steel showing green and red occupancy indicators.
   1. Latch housing: Satin stainless steel.
   2. Slide bolt and button: Satin stainless steel.
   3. Door Pulls: Satin stainless steel, typical both sides of door near latch.

C. Coat Hook and Bumper:
   1. Combination type, chrome plated Zamak.
   2. Equip outswing handicapped doors with second door pull and door stop.

D. 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.

2.4 SOLID PLASTIC PRIVACY SCREENS

A. Provide plastic privacy screens in urinal and entry toilet room applications as indicated or scheduled.

B. Panels, and pilasters, if required, 1 inch thick with edges rounded to a radius. Screens to be mounted at 12 inches above the finished floor. Color as selected by Architect from manufacturer's full line of current colors.
1. Aluminum heat sink fastened to bottom edges.
2. Recycled Content: Minimum 25 percent.

C. Screen Type: Wall mounted.
1. Urinal Screens: 24 inches wide by 55 inches high.

D. Wall Brackets: Extruded PVC plastic. Fastened to the panel/pilaster with stainless steel tamper resistant torx head screws and fastened to wall with stainless steel tamper resistant torx head sex bolts.
1. Length of Wall Brackets: 54 inches.
2. Color to match partition.

E. Aluminum Slide Bolt Latch and Housing: Heavy-duty extruded 6463-T5 alloy aluminum. Latch and housing to have a clear anodized finish. Slide bolt and button to have a black anodized finish.

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 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position for long life under hard use, plumb, level, and square.

C. Except for compartments for the handicapped, adjust doors to remain at a uniformly open position when unlocked.

D. Touchup scratches and abrasions to be permanently and completely invisible to the unaided eye from a distance of five feet.

END OF SECTION 10 2125

SECTION 10 2135 - CUBICLE CURTAINS AND TRACK

PART 1 - GENERAL

1.1 SUMMARY

A. Provide cubicle curtains and tracks where indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 09 5100: Acoustical Ceiling.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings showing method of installation, anchoring, and interface between the work of this Section and adjacent trades.

B. Contract Closeout Submittals: Manufacturer's recommended cleaning procedures in accordance with requirements of Section 01 7820.

PART 2 - PRODUCTS

2.1 CUBICLE TRACKS

A. Cubicle Curtain Tracks: Surface-mounted extruded aluminum track, complete with necessary fittings, in the arrangements and dimensions indicated on the Drawings.

B. Acceptable Products:
1. Surface Mounted Track by General Cubicle with No. 1062N carrier.
2. Model No. 2250 by Marshall-McMurray Co with No. 2218 carrier.
3. Series 7900 by Kirsch with No. 7918 carrier.
4. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 CUBICLE CURTAINS

A. Curtain Fabric:
1. Polyester (Designer Series, 100% Oxford cloth, inherently Flame Resistant Polyester, 13.5 oz. per lineal yard.
2. Highly durable and resistant to abrasion.
3. High tensile and tear strength.
4. Meet or exceed flame resistant requirements including NFPA Bulletin 701, State of California Title 19, CBC. Chapter 1, Subchapter 8. Certificate of compliance shall be sewn on the back side hem or turn back by the wall.

5. Curtains shall be 10% wider than the track length.
6. Color: As indicated on the Drawings.

2.3 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 INSTALLATION

A. Install the work of this Section in strict accordance with the manufacturer's recommendations as approved by the Architect.

B. Anchorage to Gypsum Board Ceilings: Mount track directly to ceiling and secured into solid 2x blocking with #8 pan head sheet metal screw at 24" on center.

C. Anchorage to Suspended Ceilings:
1. Mount track directly to the ceiling suspension grid system and secure to metal furring channel above the ceiling with #8 sheet metal screws at 24" on center through spacers.
2. Support furring channel with 12 gage hanger wire at 24" on center and diagonally braced with four 12 gage brace wires at 8' on center.

END OF SECTION 10 2135

SECTION 10 2240 - FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide folding panel partition system where indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
   1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
   2. Installation Procedures: Submit manufacturer's recommended installation.
   3. Shop Drawings: Submit shop drawings showing complete details of installation, anchorage, and interface with the work of other trades.
      a. Note: The plans have been designed with specific sizes for the walls at the stack area. Panels shall be sized to fit within this area. Deviations must be brought to the attention of the Architect and Contractor.

B. Contract Closeout Submittals:
   1. Operation and Maintenance manuals in accordance with requirements of Section 01 7820.
   2. Manufacturer's recommended cleaning procedures.

C. Extra Materials: Deliver operating handle to Owner.

1.3 QUALITY ASSURANCE

A. Colors: Provide finish selections indicated in the Finish Schedule.
   1. Acceptable Manufacturers: The products and manufacturers specified in the Finish Schedule are for purposes of establishing color and quality. Refer to each Specification Section for additional manufacturers and Section 01 2500 for substitution requirements.
   2. Manufacturer’s Standard Colors and Finishes: Where the Finish Schedule specifies a manufacturer’s standard color or finish, the Architect makes no guarantee that matching colors or finishes are available as other manufacturer’s “standard colors” from the listing of acceptable manufacturers. The Contractor shall be responsible for providing colors matching those indicated on the Drawings.
   3. Custom Colors: Where the Finish Schedule indicates a specific manufacturer’s colors, other acceptable manufacturers shall provide matching custom colors where a standard color is not acceptable.

1.4 SPECIAL WARRANTY

A. In addition to the warranty requirements of the Contract Documents, submit 2 original copies of an extended warranty signed by the installing subcontractor and the Contractor with a warranty correction period of **2 years**.

PART 2 - PRODUCTS

2.1 FOLDING PANEL PARTITIONS

A. Acceptable Products:
1. Classic Series 641 by HUFCOR, (800) 356-6968.
2. Model 3020, STC 52 by Kwik Wall, (217) 522-5553.
3. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Acoustical Rating: 51 or better by ASTM E90.

C. Panel Operation:
1. Top supported, manually operated individual panels, omni-directional.

D. Panel Construction:
1. Size: 4" nominal thickness, 48" nominal width.
2. Face: Class A rated facing on tackable base laminated to structural/acoustic backing.
3. Frames: Clear anodized aluminum protective edge trim designed to capture edges of face material. Face panels shall be removable and replaceable on the job site.
4. Finish Material: Vinyl wall covering.
5. Panel Weight: 10.2 psf.

E. Vertical Seals: Deep nested tongue and groove type.

F. Horizontal Top and Bottom Seals:
1. Retractable internal seal, providing constant pressure when extended.
2. Removable quick-set operating key located at waist height in panel edge.
3. Vinyl strips for complete seal upon activation.

G. Suspension System:
1. Track: Clear anodized, grade 6063-T6, extruded aluminum; factory fabricated intersections.
2. Carriers:
a. Individual omni-directional panels: Two 2-wheeled carrier assemblies at each panel.
b. Paired panels: One 4-wheeled carrier assembly at each panel.
3. Connection to Structure: Threaded rods.

H. Final Partition Closure: Lever closure panel constructed as basic panel with expanding jamb exerting a minimum of 250 lbs. constant force against wall. Expanding jamb compensated for out-of-plumb conditions and minor wall irregularities.

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 INSTALLATION

A. Coordinate as necessary with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install partition in accordance with manufacturer's written instructions, and ASTM E557, anchoring all components firmly into position.

3.3 ADJUSTING AND CLEANING

A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

B. Clean track and panel surfaces.

3.4 DEMONSTRATION

A. Demonstrate in the presence of the Owner and Architect the complete operation of the system. Comply with the In-Service Certification requirements of Section 01 7700 - Contract Closeout.

END OF SECTION 10 2240

SECTION 10 2610 - WALL AND CORNER PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Wall guards.
2. Corner guards.
3. Protective wall covering.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.

1.3 QUALITY ASSURANCE

A. Colors: Provide finish selections indicated in the Finish Schedule.
1. Acceptable Manufacturers: The products and manufacturer’s specified in Finish Schedule are for purposes of establishing color and quality. Refer to each Specification Section for additional manufacturers and Section 01 2500 for substitution requirements.
2. Manufacturer’s Standard Colors and Finishes: Where Finish Schedule specifies a manufacturer’s standard color or finish, the Architect makes no guarantee that matching colors or finishes are available as other manufacturer’s “standard colors” from the listing of acceptable manufacturers. The Contractor shall be responsible for providing colors matching those indicated on the Drawings.
3. Custom Colors: Where Finish Schedule indicates a specific manufacturer’s colors, other acceptable manufacturers shall provide matching custom colors where a standard color is not acceptable.

PART 2 - PRODUCTS

2.1 WALL GUARDS

A. Components:
1. Snap-on Covers: 0.080" minimum thickness extruded PVC with embossed surface.
2. Retainer: 0.063" minimum thickness continuous extruded aluminum with mounting accessories appropriate for the substrate indicated.
3. Accessories: 0.080" minimum thickness injection molded thermoplastic end caps and outside corners.
4. Colors: As selected by the Architect from the manufacturer's standard colors.

B. Acceptable Products:
1. Model C400 by Korogard.
2. WG-4 by Pawling Corp.
3. Acrovyn SCR-40 by Construction Specialties Inc.
4. Series 1400 by Institutional Products Corp.

C. Provide continuous sections to 12' lengths as needed. Install end caps and outside corners typical (inside corners are to be mitered).

2.2 CORNER GUARDS

A. Acceptable Products:
1. Model C815 by Korogard.
2. CG-12 by Pawling Corp.
3. Acrovyn VA-200 by Construction Specialties Inc.
4. Flexible Corner Guard, 1-1/2" wing by Institutional Products Corp.
5. Tape-On Corner Guards, 1-1/2” wing by InPro Corp.

B. Provide continuous sections to max length possible or as shown on drawings.

C. Colors: As selected by the Architect from the manufacturer's standard colors.

2.3 PROTECTIVE WALL COVERING

A. Acceptable Products:
1. 0.040" Protective Wall Covering by Korogard.
2. 0.040" WC-40 by Pawling Corp.
3. 0.040" Acrovyn VA-200 by Construction Specialties Inc.
4. 0.040" Rigid Vinyl Sheet by Institutional Products Corp.
5. 0.040” Palladium Rigid Vinyl Sheet by InPro Corp.

B. Provide continuous sections to maximum length possible or as shown on Drawings.

C. Provide manufacturer's standard trim products as needed for joints and transitions.

D. Colors and Textures: As selected by the Architect from the manufacturer's standard colors and textures.

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 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the approved Shop Drawings and the recommendations of the manufacturers as approved by the Architect, anchoring all components firmly into position in true alignment within a tolerance of one in 1000 vertically and horizontally.

C. Provide continuous pieces in the maximum length possible. Pieces shorter than 3'-0" shall not be used.

D. Provide tight fitting flush joints between pieces.

END OF SECTION 10 2610

SECTION 10 2810 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide toilet accessories where indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit dimensioned drawings as required to depict the space required for these items, and their interface with the work of other trades.

B. Contract Closeout Submittals: Operation and Maintenance manuals in accordance with requirements of Section 01 7820.

PART 2 - PRODUCTS

2.1 TOILET ACCESSORIES

A. Basis of Design: Bobrick Contura Series.
1. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Provide all listed products by one manufacturer:

GB-1: Grab Bar constructed of 18 gauge type 304 satin-finish stainless steel, horizontal 2-wall type, concealed mounting, stainless steel, 1-1/2" outside diameter; Bobrick B-6897 .

GB-2: Grab Bar constructed of 18 gauge type 304 satin-finish stainless steel, concealed mounting, stainless steel, 1-1/2" outside diameter; Bobrick B-6806-48’’. Length as noted on plan.

GM-1: Tempered Glass Mirror; satin finish stainless steel angle frame with corners mitered, ground, and polished smooth; No. 1 quality, 1/4" thick tempered select float glass selected for silvering and electrolytically copper plated by the galvanic process; concealed theft resistant mounting. Bobrick B-2908. Sizes as indicated.

HD-1: Xlerator High Efficiency Surface Mounted ADA Compliant Electric Hand Dryer by Excel Dryer, Inc. Model XL-SB-1.1N, includes Noise Reduction Nozzle. Install with ADA-Compliant Recess Kit (#40502). 110-120V, 11.3-12.2A, 1240-1450 watts, The cover shall be attached to the wall mounting plate with tamper-proof screws.

PT-1: Paper towel dispenser, with Towelmate surface mounted satin-finish stainless steel; tumbler lock on top of cabinet radius contoured front door, with one piece drawn cover; Bobrick B-4262. Owner Provided,

Contractor Installed.

PT-2: Roll-Paper towel dispenser, deep surface mounted satin-finish stainless steel; Door shall be secured to cabinet with full length stainless piano hinge, tumbler lock key; Bobrick B-2860.

SD-1: Liquid Soap Dispenser surface mounted; dispenses all-purpose soap corrosion resistant valves, contoured front with drawn cover satin stainless steel, with vessel attached to back; Bobrick B-4112.

SD-2: Counter-Mounted Automatic Liquid Soap Dispenser; dispenses all-purpose soap corrosion resistant valves, Unit equipped with spring loaded 180 deg. Rotatable lid with concealed locking mechanism for top filling; Bobrick B-878.

SNV-1: Sanitary Napkin Vendor, semi-recessed mounted, satin finish stainless steel, push button operation; Bobrick B-47064C. Owner Provided, Contractor Installed.

TP-1: Toilet Paper Dispenser surfaced mounted multi-roll dispenser; with contoured front, with one piece drawn cover and theft resistant heavy duty spindles; Bobrick B-4288.

TP-2: Toilet Paper Dispenser recessed multi-roll dispenser; Type 3-4 stainless steel with satin finish; Bobrick B-6637. Including theft resistant toilet tissue spindle, which is removable only with special key provided; Bobrick 283-604.

TSC-1: Toilet Seat Cover Dispenser; satin stainless steel contoured front, beveled flanges, no exposed corners or edges; Bobrick B-4221.

2.2 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. All fixtures shall be provided with vandal-resistant screws and attachments.

C. General Contractor shall provide solid wood, metal or masonry backing as required for all wall-mounted fixtures.

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 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install each item in its proper location, firmly anchored into position, level and plumb, and in accordance with the manufacturer's recommendations.

END OF SECTION 10 2810

SECTION 10 4400 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide fire protection specialties where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings as needed to depict the space required for these items, and their interface with the work of other trades.

B. Contract Closeout Submittals: Manufacturer's recommended operating instructions in accordance with requirements of Section 01 7820.

1.3 DEFINITIONS

A. Light (Low) Hazard Location: Locations where total amounts of Class A combustible materials is of minor quantity, including offices, classrooms, and assembly halls.

B. Extra (High) Hazard Location: Locations where the total amounts of Class A combustibles or Class B flammable are present in storage, production, or use, and/or finished product over and above those expected and classed as Ordinary (Moderate) Hazards, including laboratories, woodworking and vehicle repair.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 SURFACE MOUNTED FIRE EXTINGUISHER BRACKETS

A. J.L. Industries No. MB810 or MB818.

2.3 FIRE EXTINGUISHER CABINETS AT LIGHT (LOW) HAZARD LOCATIONS

A. Semi-recessed Cabinets at 2 X 4 Walls: J.L. Industries Cosmopolitan 8137W17, 2-1/2" projection, stainless steel, #4 satin finish, rolled edge construction with corners welded and ground smooth.

B. Recessed Cabinets at 2 X 6 (and larger) Walls: J.L. Industries Cosmopolitan 8135W17, 3/8" projection, stainless

steel with #4 satin finish, flat trim construction with corners welded and ground smooth.

C. Where cabinets occur in fire-rated construction, provide J.L. Industries FIRE-FX option; ASTM E814, labeled for 1-hour combustible and 2-hour non-combustible construction. WHI- TEST# 631-021201 / 631-021202

2.4 FIRE EXTINGUISHER CABINETS AT EXTRA (HIGH) HAZARD LOCATIONS

A. Semi-recessed Cabinets at 2 X 4 Walls: J.L. Industries Cosmopolitan 1037W17, 3" projection, stainless steel, #4 satin finish, rolled edge construction with corners welded and ground smooth.

B. Recessed Cabinets at 2 X 6 (and larger) Walls: J.L. Industries Cosmopolitan 1035W17, 3/8" projection, stainless steel with #4 satin finish, flat trim construction with corners welded and ground smooth.

C. Where cabinets occur in fire-rated construction, provide J.L. Industries FIRE-FX option; ASTM E814, labeled for 1-hour combustible and 2-hour non-combustible construction. WHI- TEST# 631-021201 / 631-021202.

2.5 FIRE EXTINGUISHER CABINETS AT KITCHEN K-RATED EXTINGUISHERS

A. Semi-recessed Cabinets at 2x4 Walls: J.L. Industries Cosmopolitan 2032W17, 4" projection, stainless steel with #4 satin finish, rolled edge construction with corners welded and ground smooth.

B. Recessed Cabinets at 2x6 (and larger) Walls: J.L. Industries Cosmopolitan 2037W17, 2-1/2" projection, flat trim construction with corners welded and ground smooth, stainless steel with #4 satin finish.

C. Where cabinets occur in fire-rated construction, provide J.L. Industries FIRE-FX option; ASTM E814, labeled for 1-hour combustible and 2-hour non-combustible construction. WHI- TEST# 631-021201 / 631-021202

2.6 COMBINATION FIRE EXTINGUISHER / FIRE HOSE CABINETS

A. Semi-recessed Cabinets at 2 X 4 Walls and 2x6 Fire Rated Walls: J.L. Industries Crownline 6237W17-1403, 2-1/2" projection, stainless steel, #4 satin finish, rolled edge construction with corners welded and ground smooth.

B. Recessed Cabinets at 2 X 6 (and larger) Walls: J.L. Industries Crownline 6235W17-1403, 3/8" projection, stainless steel with #4 satin finish, flat trim construction with corners welded and ground smooth.

C. Where cabinets occur in fire-rated construction, provide J.L. Industries FIRE-FX option; ASTM E814, labeled for 1-hour combustible and 2-hour non-combustible construction. WHI- TEST# 631-021201 / 631-021202

D. Fire Hose and Rack Assembly: J.L. Industries HRA100B Fire Hose and Rack Assembly, 1-1/2" hose and valve.
   1. Hose: FM-approved 500 lb test, single jacket polyurethane-lined hose, 100' length.
   2. Fog Nozzle: UL-rated industrial fog nozzle.
   3. Valve and Rack: Cast brass coupling angle valve, escutcheon and nipple; red enamel pin rack; UL-rated.
   4. 100 gpm at 65 psi at nozzle.
   5. Class II service.

2.7 FIRE EXTINGUISHERS

A. Light (Low) Hazard Locations: Provide one multi-purpose, dry chemical, 5 lb. fire extinguisher, **UL rating of 3A-40BC** at each cabinet.
   1. Heavy duty steel cylinder, metal valve and siphon tube, replaceable molded valve stem seal, corrosion and impact resistant epoxy finish, visual pressure gauge, pull pin, upright grip operation.
   2. JL Industries, Cosmic 5E or approved equal.

B. Extra (High) Hazard Locations: Provide one multi-purpose, dry chemical, 10 lb. fire extinguisher, **UL rating of 4A-80BC** at each cabinet.
   1. Heavy duty steel cylinder, metal valve and siphon tube, replaceable molded valve stem seal, corrosion and impact resistant epoxy finish, visual pressure gauge, pull pin, upright grip operation.
   2. JL Industries, Cosmic 10E or approved equal.

C. Kitchens: Wet chemical fire extinguisher, 6 liter fire extinguisher, **UL rating of "K"**.
   1. Heavy duty stainless steel cylinder construction, metal valve and siphon tube, corrosion and impact resistant epoxy finish.
   2. Visual pressure gauge, pull pin, upright grip operation.
   3. Protective nozzle tip orifice seal, industry standard discharge horn and nozzle design.
   4. Nameplate showing only class "K" symbol, non-metallic nozzle tip finger guard.
   5. Installed fire extinguisher shall be within 30'-0" of the kitchen hood system.
   6. JL Industries, Saturn 15 or approved equal.

D. Service, charge, and tag each fire extinguisher not more than five calendar days prior to the Date of Substantial Completion of the Work as that Date is established by the Owner.

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 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Owner, anchoring all components firmly into position for long life under hard use.

C. Locate bracket-mounted extinguishers where directed by the Owner and the Fire Department official.

END OF SECTION 10 4400

SECTION 10 7500 - FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide internal halyard flagpoles and foundations where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Indicate typical layout including dimensions, base design, and base connection to foundation, anchoring and support system, and electrical grounding system. Submit detailed drawings of special accessory components not included in manufacturer's product data.

B. Contract Closeout Submittals: Operation and Maintenance manuals in accordance with requirements of Section 01 7820.

PART 2 - PRODUCTS

2.1 FLAGPOLES

A. Approved Manufacturers:
1. American Flagpole Division of Kearney-National, Inc.
2. Acme Flagpoles Company Division of Lingo, Inc.
3. Babcock-Davis Associates, Inc.
4. The Morgan-Francis Co., Inc.
5. Pacific Coast Flagpole Co.
6. Pole-Tech Co. Inc.
7. Interstate Pole Industries.
8. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Provide flagpoles, accessories, bases, and anchorage devices as complete units furnished by one manufacturer, and with the following attributes:
1. Overall dimensions: 34'-0" high, with 7" butt and 3-1/2" top diameter, wall thickness of 0.188", and 42" ground set; brushed satin aluminum finish.
2. Design:
a. Cone tapered sections above cylindrical butt sections, manufactured from seamless aluminum tube of 6063-T6 alloy, heat treated and age hardened.
b. Clear anodized aluminum 5" dia. ball with flush seam. Cast aluminum single stationary truck.
c. Internal Halyard: 5/16" diameter braided polypropolene rope with 2 chrome plated bronze swivel snaphooks, plastic covered counterweight, and beaded sling.

d. Cam Cleat: Manually operated cam cleat includes a flush access door with cylinder lock and continuous piano hinge mounted at a maximum of +48" above finish grade. Operable mechanism shall not require tight grasping, pinching, or twisting to operate.
e. Collar: Spun aluminum flash collar finished to match pole.

3. Foundation Sleeve: 16 gage galvanized corrugated steel tube with 3/16" thick steel base and support plate, steel centering wedges, and lightning spike. Provide shop coat of asphaltic paint inside and outside.

C. Provide lightning protection system as standard with the approved manufacturer and as approved by governmental agencies having jurisdiction.

2.3 FOUNDATIONS

A. Provide the services of an engineer properly licensed to perform such work at the location of the Work, and design a ground set foundation for each flagpole to comply with pertinent requirements of governmental agencies having jurisdiction.

B. Provide such drawings and calculations as are required, make necessary arrangements and pay such costs as are involved, and secure approvals of governmental agencies having jurisdiction.

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 INSTALLATION

A. Install the flagpoles and accessories in strict accordance with the manufacturers' recommendations as approved by the Architect, aligning plumb to a vertical tolerance of one in 1000, and adjusting operating components for optimum smoothness of operation.

END OF SECTION 10 7500

SECTION 11 4000 - FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Provide food service equipment, including stainless steel items, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 06 4000: Rough openings for equipment and accessories in cabinets.
3. Section 22 0000: Final plumbing connections of equipment and accessories.
4. Section 26 7000: Final electrical connections of equipment and accessories.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings showing details of layout, installation, anchorage, and interface with the work of other trades.
4. **Utility Service Connections:** Deviations from utility requirements indicated on the Drawings shall be clearly noted and coordinated with the trades involved.

B. Contract Closeout Submittals: Submit in accordance with Section 01 7700.
1. Operation and Maintenance manuals in accordance with requirements of Section 01 7820.
2. Manufacturer's recommended cleaning procedures.

1.3 QUALITY ASSURANCE

A. Except as otherwise specifically approved in writing by the Architect, manufacture and install all materials of this Section in strict compliance with at least the minimum requirements of:
1. Underwriters' Laboratories, Inc.(UL);
2. American Gas Association (AGA);
3. American Society for Testing and Materials (ASTM);
4. American Society of Mechanical Engineers (ASME);
5. National Sanitation Foundation (NSF);
6. National Fire Protection Association (NFPA);
7. All governmental agencies having jurisdiction.

B. Provide refrigeration systems with materials in compliance with EPA and Federal Air Emissions Controls Laws governing and prohibiting the use of Ozone Depleting Refrigerants.

1.4 SPECIAL WARRANTY

A. In addition to the warranty requirements of the Contract Documents, submit 2 original copies of the manufacturer's **5-year** factory warranty on all refrigeration equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Provide only new materials, of the highest grade available, free from defects and imperfections, of recent manufacture, and with the following attributes except as may be otherwise approved by the Architect.
   1. Where two or more identical articles or pieces of equipment are required, provide of identical manufacture.
   2. Where model numbers are indicated and the specified models are no longer manufactured, provide the manufacturer's updated model if approved by the Architect.

C. Bolts, Screws, and Rivets:
   1. Wherever possible, provide equipment and connections with exposed surfaces free from bolt heads, screw heads, and rivets.
   2. Wherever bolts are used to fasten trim to paneling of counters, cabinets, and similar equipment, and to fasten tops of counters to their framing, use corrosion-resisting metal of the same alloy composition as the metal to which they are fastened.
   3. When iron bolts or screws are authorized to be used, provide a suitable metallic coating for protection against corrosion.
   4. Wherever threads of bolts or screws might come into contact with a wiping cloth, cap the threads with a suitable lock washer and chromium plated or bronze acorn nut.

D. Provide all items of equipment complete with starters, controls, and similar items as needed for proper and recommended operation.

E. Provide drawer pulls complying with CBC Section 11B-309.4.

2.2 MATERIALS

A. Stainless steel:
   1. Provide US Standard Gage 18-8, type 302, maximum carbon .012%, with No. 4 finish;
   2. Where spans exceed 30" in the least direction, provide 16 gage material;
   3. Where spans exceed 60" in the least direction, provide 14 gage material;
   4. Finish welds to match the No. 4 finish.

B. Welding and Soldering:
   1. Shop weld or solder all seams and joints as the nature of the material used may require;
   2. Weld all materials 18 gage and heavier.

C. Metal Tops:
   1. Provide metal tops of one piece welded construction, reinforced on the underside with galvanized steel channels welded in place so tops can support heavy weights without deflection;
   2. Provide cross braces at not closer than 30" on centers.

D. Except as otherwise detailed or specified, make rolled edges approximately 1-3/8" in diameter, with corners bullnosed, ground, and polished.

E. Corners:
   1. At dish tables, drain tables, backsplashes, and turned-up edges, provide radius bends in all horizontal and vertical corners, coved at intersections, unless otherwise detailed or specified;
   2. Make rounded and coved corners, and radius bends, 1/2" radius or more.

F. Legs and Cross Rails:
   1. Fabricate from 16 gage 1-5/8" diameter stainless steel tubing unless otherwise detailed or specified;
   2. At cross rails, make all welds continuous and grind smooth; tack welds are not acceptable;
   3. Fit the bottoms of legs at the floor with a stainless steel bullet-type foot having not less than 2" adjustment;
   4. Fasten legs to equipment:
      a. To sinks by means of completely enclosed sanitary stainless steel gussets welded into place and reinforced with bushings having set screws for securing the legs;
      b. To metal tops and dish tables with the same type enclosed gussets as specified above, but welded to stainless steel channels 14 gage or heavier.
   5. Stainless steel adjustable feet:
      a. Provide 302 or 304 stainless steel exterior on not less than 1-1/2" diameter threaded cold rolled steel rod;
      b. Provide not less than 2" adjustment;
      c. Weld the assembly, and provide seismic anchorage approved by the Architect and Division of the State Architect.

G. Shelves:
   1. At fixtures with enclosed bases, turn up shelves at back and sides, and feather slightly to assure a tight fit to enclosure panels;
   2. At fixtures with open bases, notch shelves a full 90̊ and weld tightly to leg with tight joints at all intersections of shelf and leg.

H. Closures: Fill the ends of all fixtures, backsplashes, shelves, and similar items, by forming the metal or welded sections, if necessary, to finish the entire rear of the fixture or similar item flush to walls and adjoining fixtures.

2.3 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. Kitchen equipment supplier to provide DSA approved equipment anchorage details and devices for seismic connections at no additional cost.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine areas and conditions under which the 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, GENERAL

A. Except as modified by requirements of governmental agencies having jurisdiction, install in accordance with recommendations of the manufacturer as approved by the Architect and the pertinent UL design requirements.

B. Coordinate with adjacent trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

C. Put all items of equipment through at least five complete cycles of operation, adjusting as needed to assure proper operation.

3.3 SEISMIC RESTRAINT

A. All “hardwire and gas” kitchen equipment shall be installed with seismic restraints per *Guidelines for Seismic Restraints of Kitchen Equipment* as published by SMACNA and approved by DSA.

B. Where anchorage details are not shown on the drawings or in the guidelines, the field installation shall be subject to the approval of the Architect and the DSA Field Engineer.

C. A copy of the *Guidelines for Seismic Restraints of Kitchen Equipment* shall be provided by the Contractor and kept on the job site at all times.

3.4 CLEANING UP

A. In addition to other stipulated requirements for cleaning, completely remove finger prints and traces of soil from the surfaces of all work of this Section, using only those cleaning materials recommended for the purpose by the manufacturer of the material being cleaned.

3.5 DEMONSTRATION

A. Upon completion and prior to the acceptance of the work of this Section, schedule and conduct a meeting with the Owner and his personnel to train and thoroughly familiarize them with information necessary to operate and maintain the work. Include, but do not limit the training to:
   1. Warranty coverage and requirements;
   2. Operation and maintenance manuals;
   3. Special tools and spare parts;
   4. Safety procedures and requirements;
   5. Manufacturer's recommended cleaning procedures;
   6. Identification systems;
   7. System operation and features including, but not limited to:
      a. Start-up;
      b. Control sequences;
      c. Shut down;
      d. Controls manipulation;
      e. Emergency procedures;
      f. Noise/vibration adjustment;
      g. Effective energy utilization.
   8. System maintenance.

B. Demonstration Meeting:
   1. Minimum of 4 hours.
   2. Demonstrate system through a minimum of 3 cycles.
   3. Prepare and execute In-Service Certification form and submit with closeout documentation.

END OF SECTION 11 4000

SECTION 11 4100 - WALK-IN REFRIGERATOR/FREEZER

PART 1 - GENERAL

1.1 SUMMARY

A. Provide prefabricated modular walk-in cooler/freezers, with refrigeration system, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 09 6710: Epoxy Flooring.
3. Section 22 0000: Plumbing.
4. Section 23 0000: Ductwork.
5. Section 26 7000: General Electrical.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Submit manufacturer's recommended installation procedures which.
3. Shop Drawings: Submit shop drawings showing details of layout, installation, anchorage, and interface with the work of other trades.

B. Contract Closeout Submittals:
1. Operation and Maintenance manuals in accordance with requirements of Section 01 7820.
2. Manufacturer's recommended cleaning procedures.

1.3 QUALITY ASSURANCE

B. Except as otherwise specifically approved in writing by the Architect, manufacture and install all materials of this Section in strict compliance with at least the minimum requirements of:
1. Underwriters' Laboratories, Inc. (UL);
2. American Society for Testing and Materials (ASTM);
3. American Society of Mechanical Engineers (ASME);
4. National Sanitation Foundation (NSF);
5. National Fire Protection Association (NFPA);
6. All governmental agencies having jurisdiction.

B. Fire Performance Characteristics: Provide components identical to those tested for the following fire performance characteristics, according to ASTM test method indicated, by an independent testing and inspecting agency acceptable to authorities having jurisdiction. Identify components with appropriate marking of testing and inspection agency.
1. Surface Burning Characteristics:
a. Flame Spread: 25 or less per ASTM E84.
b. Smoke Density: 450 or less per ASTM E662.

1.4 SPECIAL WARRANTY

A. In addition to the warranty requirements of the Contract Documents, submit 2 original copies of the manufacturer's **5-year** factory warranty on all refrigeration equipment.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 WALL, CEILING, PARTITION AND FLOOR PANELS

A. Prefabricated, modular panel consisting of foamed-in-place insulation between interior and exterior die-formed metal faces.
   1. Insulation: Foamed-in-place urethane, average in-place density of 2.2 pcf, 97% closed cell structure.
   2. Metal Facing:
      a. Exterior floor and ceiling: 26 gage galvanized steel.
      b. Exterior walls: 20 gage Type 304 stainless steel.
      c. Interior walls and ceilings: 20 gage galvanized steel.
      d. Interior floor: 16 gage Type 304 stainless steel.
   3. Panel Thickness: 4", R-value of 34.
   4. Panel Widths: 11-1/2", 23", 34-1/2", and 46", interchangeable with like panels.
   5. Special Panel Shapes:
      a. Corner panels: 90 degree angle, 12" wide each exterior face.
      b. Tee panels: 23" x 12" symmetrical tee.
   6. Panel Locking Devices: Minimum of 3 locking devices on each panel side and 1 locking device on each panel end, on interior face.
      a. Cam action rotating locking arm located in the in the tongue edge of panel.
      b. Locking arm operated by hex wrench to extend a hook arm into the adjoining panel, engage a locking pin, and retract to pull panels tightly together.
      c. Provide snap-on cap to match panel finish.
      d. Maximum distance between locks: 46".
   7. Panel Gaskets: Flexible vinyl gaskets, foamed-in-place on the interior and exterior edge of tongue rail, NSF approved and flame retardant.
   8. Panel Fabrication:
      a. Form double tongue-and-groove on all edges for air-tight and vapor-tight fit.
      b. Double return bend metal facing for interlock with foam insulation.
   9. Floor Panel Fabrication: Design and construct to withstand uniformly distributed loads of 700 psf.
      a. Provide aluminum diamond tread plate flooring in freezer compartment.
      b. Provide 34" x 36" aluminum integral ramp and cove base.
   10. Preinstall all conduit and switch/alarm J-boxes in panel sections with recessed splice boxes at exterior ceiling panels.

2.3 DOORS

A. Entrance Doors: Prefabricated doors consisting of foamed-in-place insulation between interior and exterior die-formed metal faces, mounted in panel construction to form modular unit. Provide UL listing for entire door assembly, including electrical accessories.
   1. Insulation: Foamed-in-place urethane, average in-place density of 2.2 pcf, 97% closed cell structure.

2. Interior and Exterior Metal Facing: 20 gage Type 304 stainless steel.
3. Door Thickness: 4", R-value of 34.
4. Internal Reinforcing:
    a. 14 gage steel channel at perimeter of door and across interior and exterior faces at hinge and latch stress points and at protector plates.
    b. Provide steel plates behind door closers, latches, kick plates, and other hardware.
5. Door Edging: 4" wide, 1/4" thick thermally-fused extruded PVC to accept metal door facings and provide thermal break, formed to accept magnetic gasket.
6. Door Jamb and Frame: FRP with molded channel to accept anti-sweat heater and allow easy replacement of heater.
7. Freezer Door: Provide anti-sweat heater concealed behind door jamb.
8. Manual Sliding Door Hardware:
    a. Door Hanger and Track: Heavy-duty adjustable door hanger and rolling track; floor-mounted stay rollers, and traveling heat cable.
    b. Latching device: Heavy-duty chrome-plated brass lock hasp, with interior stainless steel or brass components and interior recessed safety release.
9. Gasketing:
    a. Head and jambs: Satin black vinyl gasket with magnetic core, all corners welded. Magnetic force shall be sufficient to keep door in a closed position and form tight seal.
    b. Threshold: Flexible, double wiper EPDM extrusion, FDA approved.
10. Threshold: 12 gage Type 304 stainless steel.
11. View Window:
    a. Approximately 336 square inches, 1/4" thick, triple-pane, condensation-free, lexan or tempered plate glass window, mounted at +48".
    b. At freezer provide heated glass with transparent tin coating at interior on exterior panel, on same circuit as door heater.

2.4 REFRIGERATION SYSTEM

A. Dual Compressor Refrigeration Systems:
1. Acceptable Products: Master-Bilt DRS Model RSPR1114C.
2. Remote refrigeration systems shall be composed of two condensing unit modules containing an air-cooled condenser, compressor, generously-sized receiver and other appropriate components, enclosed in a galvanized steel housing on a common base and frame assembly.
3. Provide a separate refrigerant circuit for each condenser providing independent function of each system.
4. Provide scroll compressors for freezers; provide hermetic compressors for coolers.
5. Factory pre-wire each system to an electrical panel for one-point connection.
    a. Provide all operating controls (including fan and compressor), a pre-wired, installed and preset fan-cycling switch, crankcase heater, pre-wired electrical control panel with pre-mounted and wired defrost timers.
6. Factory Pre-piping: Pre-installed and tested liquid and suction line kits.
    a. Provide liquid line drier and sight glass, shut-off valve, and heavy-duty compressor with suction service valve.
    b. Extend piping edge of the unit base and pre-tested piping to that point, requiring only piping between condensing unit and evaporator, evacuation and charging.
7. Provide electrical panel with individual breakers for compressors, contactors and time clocks for both low and medium temp units.
8. Provide pre-set, non-adjustable high and low pressure controls in medium temp units; adjustable low pressure control in low temp units.

B. Evaporators:
1. Acceptable Products: Master-Bilt E-Series evaporators, heavy-duty unit coolers utilizing either off cycle air defrost (models E1H) or electric defrost (models E1M, E1L, E4M and E4L).

2. Off cycle air defrost models shall include room temperature control and externally equalized and adjustable expansion valve. Electric defrost models shall include defrost heaters, drain pan heaters, heater safety control, defrost termination control, fan delay control, room temperature control, drain line heaters, and an externally equalized and adjustable expansion valve.

C. Provide pump-down cycle kits, refrigeration lines, insulation, thermo-expansion valves, refrigerant, pressure relief valves, and inlet/shut-off valves.

D. Control temperatures by a thermostat controlling liquid line solenoid valve for compressor. Mount thermostat within 2'-0" of the evaporator, in the return air flow.
1. Freezer Temperature: -10 to -5 degrees F.
2. Cooler Temperature: +35 to +40 degrees F.

E. Refrigerant Piping:
1. Hard drawn Type L copper, ASTM B88; wrought copper fittings, silver alloy brazed, 1100F, Silos.
2. Size 3/8" and smaller shall be refrigerant tube, ASTM B280.

F. Refrigerant Piping Insulation:
1. Foamed plastic rubber-based blastomeric preformed pipe insulation; thermal conductivity not exceeding 0.27 Btu-in/hr-ft^{2}-F at a mean temperature of 70F; 1/2" thick; adhesive by same manufacturer; Armstrong Armaflex or approved equal.
2. PVC Jacketing for Pipe, Fittings, and Valves: Remolded polyvinyl chloride (PVC) jackets, 0.020" thick; size to match application; provide solvent weld adhesive and PVC vapor barrier pressure sealing tape by same manufacturer; Zeston.
3. Aluminum Jacketing: Aluminum pipe and fitting jacketing, 0.016" thick for straight pipe, 0.024" thick for fittings; integral moisture barrier; stucco-embossed finish; prefabricated aluminum strapping and seals by the same manufacturer; Childers.
4. Outdoor Mastic: Childers CP-10, Foster 65-05.

2.6 ACCESSORIES:

A. Thermometer: Digital thermometer with constant read-out display, audio warning buzzer, and remote sensor, National No. TNC-TM-100 or approved equal.
1. Provide 1 thermometer for each compartment.
2. Secure to recessed splice box with a non-conductive stub out to exterior ceiling surface. Provide "EY" seal-offs.
3. Provide permanent label under each read-out identifying compartments and their operating temperatures.

B. Compartment Lights:
1. Provide 1 incandescent vapor-proof light on the interior jamb of each door, with coated glass shatterproof globe, capable of accepting 100 watt appliance bulbs.
2. Switch: Toggle switch and pilot light with stainless steel cover plate on interior and exterior jamb, concealed factory-wiring to light. Interior pilot constant burning and exterior pilot indicating.

C. Display Door Lights: Provide fluorescent lights at each side of door for display illumination, 115-60-1 AC electrical service.

D. Pressure Relief Vent: Provide means of automatically equalizing pressure differential between interior and exterior of the walk-in.
1. Mount in side panel away from direct air stream flowing from evaporator coils.
2. Flapper type with minimum of 5" x 5" inhale/exhale port.
3. Heat each port door with easily replaceable heater wire.

E. Freezer Door Heater: Provide perimeter door heater fitted with low-conductor, anti-sweat heater wires, fully enclosed in metal, easily replaceable, for freezer compartments.

F. Shelving: Heavy-duty, plated, 5-tier adjustable shelves behind each display door, 24" deep.

G. Trim Strips: Provide trim strips between walk-in panels and building walls and ceilings. Construct of same material as exterior facing of wall panels.

H. 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 areas and conditions under which the 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, GENERAL

A. Except as modified by requirements of governmental agencies having jurisdiction, install in accordance with recommendations of the manufacturer as approved by the Architect and the pertinent UL and NSF design requirements.

B. Cooperate as needed with adjacent trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 REFRIGERANT PIPING

A. Refrigerant Piping Installation:
1. Cut pipe square.
2. Thoroughly clean, fit, and erect joint surfaces before brazing.
3. After installation, evacuate to 29" of mercury, ambient temperature during evacuation shall not be less than 70 degrees F.
4. After evacuation, fill with dry nitrogen to 250 psi and maintain for 2-hour period without additional charge.
5. After nitrogen test, purge with refrigerant charged through dryer and maintain holding charge in system and equipment.
6. Run refrigerant piping below grade in 4" PVC conduit (minimum size) with long radius ells. Seal ends of conduit watertight.

B. Refrigerant Piping Insulation: Insulate all refrigerant lines and extend through ceilings and concealed spaces as required.
1. Cover piping with foamed plastic insulation. Thoroughly cement longitudinal and end seams with adhesive in accordance with the manufacturer's recommendations.
2 Cover pipe insulation exposed to view with PVC jacketing.
3 Cover pipe insulation exposed to weather with aluminum jacketing; seal all joints with outdoor mastic.

3.4 CLEANING UP

A. In addition to other stipulated requirements for cleaning, completely remove finger prints and traces of soil from the surfaces of all work of this Section, using only those cleaning materials recommended for the purpose by the manufacturer of the material being cleaned.

3.5 DEMONSTRATION

A. Upon completion and prior to the acceptance of the work of this Section, schedule and conduct a meeting with the Owner and his personnel to train and thoroughly familiarize them with information necessary to operate and maintain the work. Include, but do not limit the training to:
   1. Warranty coverage and requirements;
   2. Operation and maintenance manuals;
   3. Special tools and spare parts;
   4. Safety procedures and requirements;
   5. Manufacturer's recommended cleaning procedures;
   6. Identification systems;
   7. System operation and features including, but not limited to:
      a. Start-up;
      b. Control sequences;
      c. Shut down;
      d. Controls manipulation;
      e. Emergency procedures;
      f. Noise/vibration adjustment;
      g. Effective energy utilization.
   8. System maintenance.

B. Demonstration Meeting:
   1. Minimum of 4 hours.
   2. Demonstrate system through a minimum of 3 cycles.
   3. Prepare and execute In-Service Certification form and submit with closeout documentation.

3.6 EQUIPMENT INFORMATION

A. Refer to product information sheets at the end of this Section.

END OF SECTION 11 4100

SECTION 11 5210 - PROJECTION SCREENS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide projection screens where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 26 7000: General Electrical

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings showing details of layout, installation, anchorage, and interface with the work of other trades.

B. Contract Closeout Submittals:
1. Operation and Maintenance manuals in accordance with requirements of Section 01 7820.
2. Manufacturer's recommended cleaning procedures.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Upon completion of the installation and where called for, retain the switch key in a secure location to prevent unauthorized operation of the screen motor.

PART 2 - PRODUCTS

2.1 PROJECTION SCREENS

A. **Type "A"(MULTI-USE ROOM):** Heavy-duty, concealed in ceiling with auto closing door, UL listed, automatic electric projection screen with the following attributes:
1. Acceptable products:
a. Basis of Design: Tensioned Advantage (with Closure Door) by Da-lite Screen Company.
b. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.
2. Size: 126" high x 168" wide.
3. Tensioned Screen - Front Projection:
a. Viewing Surface Basis of Design: HD Progressive 1.1 by Da-Lite, for front projection; viewing angle 85 degrees, gain 1.1.
b. Tensioning System: Tab guide cable to maintain even, lateral tension and hold viewing surface flat; bottom end of fabric inserted into a custom aluminum slat bar with added weight to provide vertical tension on the screen surface.
c. Screen Material: Flame retardant, mildew-resistant seamless vinyl, black backed, with standard

black borders, easily cleaned with mild soap and water solution.

4. Screen Drop: Provide extra drop of 36 inches in black fabric.
5. Motor operator: 120 V, 60 Hz, 1.2 amps; preset and adjustable limit switches to automatically stop viewing surface and case closure door in UP or DOWN position.
6. Screen Mounting: Ceiling recessed.
7. Screen Case: Single piece extruded aluminum; sliding, automatically operated aluminum screen closure door; black powder coated finish.
8. Control: Recessed wall-mounted 3-position key switch with stainless steel cover plate.
9. Video Projector Interface Control: External, DC controls to raise or lower screen automatically when projector is turned ON or Off; with low voltage 3-button switch with cover plate for wall switch operation.

B. 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 INSTALLATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position for long life under hard use.

C. Put each operating component through at least five complete operating cycles, and adjust as needed to achieve optimum operating status.

D. This Contractor to provide specific mounting details required for various related ceiling systems. Coordinate with General Contractor. **General contractor to provide required framing** at no additional cost to Owner.

END OF SECTION 11 5210

SECTION 11 6140 - PLATFORM CURTAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide platform curtains, valances, tracks, motorized curtain operators, and accessories where indicated on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings showing details of layout, installation, anchorage, and interface with the work of other trades.
4. Samples: Provide four 2" x 2" fabric samples of each color specified.

B. Contract Closeout Submittals:
1. In-Service Certification, on form provided in Section 01 7700, upon completion of Owner instruction.
2. Operation and Maintenance manuals in accordance with requirements of Section 01 7820.
3. Manufacturer's recommended cleaning procedures.

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.

B. Colors: Provide finish selections indicated in the Finish Schedule or this Specification.
1. Acceptable Manufacturers: Products and manufacturers specified in the Finish Schedule are for purposes of establishing color and quality. Refer to each Specification Section 01620 for additional manufacturers and Section 01 2500 for substitution requirements.
2. Manufacturer’s Standard Colors and Finishes: Where Finish Schedule or this Specification specifies a manufacturer’s standard color or finish, Architect makes no guarantee that matching colors or finishes are available as other manufacturer’s “standard colors” from listing of acceptable manufacturers. Contractor shall be responsible for providing colors matching those indicated on Drawings.
3. Custom Colors: Where Finish Schedule indicates a specific manufacturer’s colors, other acceptable manufacturers shall provide matching custom colors where a standard color is not acceptable.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 CURTAIN TRACKS AND CARRIERS

A. Curtain Tracks:
1. Acceptable Products: Besteel Model 170 Curtain Tracks by Automatic Devices Co., or Tru-Roll No. 1000 by Grosh, or Model 101 by H & H Specialties Inc.
2. 14 gauge galvanized steel construction entirely enclosed except for slot in bottom, each half to be in one continuous piece.

B. Curtain Carrier:
1. Plated steel construction with 2 polyethylene wheels held to the steel block by a rust-proof nickel plated rivet; wheels rolling on two separate parallel trends.
2. Space each carrier on 12" centers.
3. Each curtain carrier shall consist of a free-moving plated swivel to accommodate curtain snap hook.
4. Live-end and dead-end pulley blocks shall be adjustable and shall be equipped with 1-3/16" diameter sleeve-bearing wheels adequately guarded.
5. Provide 2 end stops for placement at each track end and a tension floor pulley for increasing cord tension.
6. Provide stretch-resistant operation cord with synthetic center and shall be of 1/4" diameter, extra quality yarn.

2.3 CURTAINS

A. Comply with the following code requirements:
1. Title 19, California Code of Regulations, Section 3.08.
2. NFPA 701.
3. California Building Code Section 806.
4. NFPA 80, Chapter 20.
5. Certificate of Compliance label shall be sewn on the back side of hem or turnback by the wall.

B. Proscenium Curtain and Valance:
1. Curtain Fabric: Km Fabrics, Inc Marvel #1143 Colonial Brick with (Black) Denim or Ranger cloth lining.
2. Valance Fabric: Km Fabrics, Inc Marvel #1143 Colonial Brick with (Black) Denim or Ranger cloth lining.

2.5 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, subject to the approval of the Architect.

B. Aluminum: Alloy and temper recommended by manufacturer for strength and corrosion resistance, mill finish, ASTM B 221 for extrusions.

C. Supports, Clamps, and Anchors: Sheet steel in manufacturer's standard gages, galvanized after fabrication in accordance with ASTM A 153, Class B.

D. Support Chain: FS RR-C-271, Type II, Class 2 weldless, double-loop steel pattern chain, not less than No. 6/0, 0.192" thickness.

2.6 CURTAIN OPERATION

A. Provide curtain motor operator. The entire mechanism shall be mounted on steel base.

B. Motor Operator:
1. Fully automatic, 1/3 hp 115v single phase motor, with elevator-type grooved cable drum delivering a

cable speed of 89 feet per minute equivalent to curtain separation speed of 3 feet per second.
2. Provide magnetic contactor to provide reversing action at any point along the travel.
3. Provide three-button control remote mounted switch control. Control switch wiring shall be accomplished through full voltage system running from control switch on the mechanism to the remote control switch.
4. Provide limit switch assembly mounted integrally with gear unit.
5. Provide curtain machine enclosure to completely cover machine and rotating drum.
6. Provide disconnect switch, automatic overload protective breaker, and emergency hand crank for conversion to manual operation unless equipped with cable tension device.

2.7 FABRICATION

A. Platform Curtain Fabrication:
1. Provide not less than 50 percent additional fullness for curtains and valances. Horizontal seams and fabric less than half-width are not permitted.
2. Vertical Hems: Provide vertical hems not less than 3 inches wide, double-stitched and machine-sewn with no selvage material visible.
3. Turnbacks: Where specified, provide turnbacks, formed by folding 24 inches of face fabric back at each end of panels and securing by sewing across top hem and grommeting through both layers of fabric.
4. Top Hems: Reinforce top hems by double-stitching 3-1/2 inch wide heavy jute webbing to top edge with minimum 1" of face fabric turned under.
5. Pleats:
    a. Provide fullness in curtains with round pleats formed by grommeting.
    b. Provide not less than #2 brass grommets along top hem reinforcing, spaced so that 6 inches of material can be gathered into a pleat every 12 inches, by means of tie lines or "S" hooks.
    c. Provide brass grommets for curtains at 6 inches o.c. spacing.
    d. Arrange vertical seams of valances and borders so that they fall within pleats.
6. Bottom Hems:
    a. Except for curtains which hang to floor, provide bottom hems not less than 6 inches deep.
    b. For floor-length curtains, provide 6" hems with separate interior heavy canvas chain pockets equipped with No. 8 cadmium-plated jack chain.
    c. Stitch chain pocket so chain rides 2 inches above bottom edge of curtain.
7. Lining: All hems and selvage edges shall not be visible from either side of each curtain.
8. Front Setting: Fabricate front curtain with 24" turnbacks at each end of both panels.

B. Track Fabrication:
1. Straight Curtain Tracks:
    a. Manually-operated cord-drawn track.
    b. Provide curtain carriers for track spaced at 12" on center.
    c. Track shall run full length of curtain opening (wall to wall).
2. Heavy-Duty Track:
    a. Equip track with heavy-duty live end double pulley and heavy-duty dead end single pulley, with 5" nominal cast-iron wheels on ball bearings, enclosed in steel housings.
    b. Provide curtain carriers of molded nylon with pair of neoprene-tired, ball-bearing wheels riveted parallel to body. Equip carriers with neoprene or rubber bumper, heavy-duty swivel eye and trim chain for attachment of curtain snap or "S" hook.
    c. Provide end stops for track and adjustable floor block designed to maintain proper tension on 3/8" stretch-resistant operating line of braided polypropylene or fiberglass center cord.
    d. Equip carriers with back pack guide accessory to permit off platform curtain folding.

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.

B. Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of tracks.

C. **General contractor shall provide all backing above the curtain track typical. This contractor to coordinate location.**

3.2 INSTALLATION

A. General:
1. Install materials in accordance with manufacturer's printed instructions and recommendations, and to comply with governing regulations.
2. Secure chains either directly to structures or to inserts, eye-screws, or other devises which are secure and appropriate to substrate, and which will not deteriorate or fail with age or elevated temperatures.

B. Tracks:
1. Ceiling-mounted: Drill track at intervals not greater than manufacturer's recommended spacing and fasten directly to structural ceiling.
2. Install track for center-parting curtains with not less than 2'-0" overlap of track sections at center, supported by special lap clamps and extend fully to wall on each end.

C. Curtains: Secure curtains to track carriers with track manufacturer's special heavy-duty "S" hooks or snap hooks.

3.3 CLEAN UP

A. In addition to other stipulated requirements for cleaning, completely remove traces of soil from the surfaces of all work of this Section, using only those cleaning materials recommended for the purpose by the manufacturer of the material being cleaned.

3.4 DEMONSTRATION

A. Upon completion and prior to the acceptance of the work of this Section, schedule and conduct a meeting with the Owner and his personnel to train and thoroughly familiarize them with information necessary to operate and maintain the work. Include, but do not limit the training to:
1. Operation and maintenance manuals;
2. Manufacturer's recommended cleaning procedures;
3. System operation and features;

B. Demonstration Meeting:
1. Demonstrate system through a minimum of 2 cycles.
2. Prepare and execute In-Service Certification form and submit with closeout documentation.

END OF SECTION 11 6140

SECTION 11 6820 - EXTERIOR COURT ATHLETIC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Provide outdoor recreation equipment where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 31 2000: Earthwork
3. Section 32 1210: Asphaltic Concrete Paving
4. Section 32 1720: Site Painting and Markings

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Submit manufacturer's recommended installation procedures.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Outdoor equipment products in this section are by LA Steelcraft. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other approved manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Acceptable manufacturers:
1. LA Steelcraft
2. Porter
3. Draper

2.2 BASKETBALL

A. Single standard, Model 12C56 by LA Steelcraft, 5-9/16" post, 6' extension; backboard 07 with 2" wide target and border, Model 600N goal with nylon net.
1. Footing: 30" dia. x 54" deep concrete.
2. Finish: Galvanized.
3. Post Pads: Model PP-656 by LA Steelcraft.

B. Double standard, Model 12C056 by LA Steelcraft, (2) 5-9/16" posts, 6' extension; backboard 07 with 2" wide target and border, Model 600N goal with nylon net.
1. Footing: 30" dia. x 54" deep concrete.
2. Finish: Galvanized.
3. Post Pads: Model PP-656 by LA Steelcraft, color as selected from manufacturer's standard colors.

Delete the article below if volleyball nets are not included in the project.

2.3 VOLLEYBALL

A. Volleyball Posts and Sleeves:
   1. Pair 3-1/2" posts per court, with cast in sleeve for 3-1/2" O.D. post with locking and sealing steel cap and wrench (1 per set), welded bottom drain pipe, and steel rod post support.
   2. Footing: 18" dia. x 39" deep, 3000 psi concrete.
   3. Acceptable Products: Combination Volleyball/Badminton Post Model VBBM3-BG with Model 350E cast-in sleeve by LA Steelcraft.

B. Volleyball Nets:
   1. One net per court, 4" sq. mesh, #42 black nylon, white top, bottom and end binding, 5/32" vinyl covered aircraftt cable through top and bottom, 3000 pund break strength, with wood dowel in end binding. 32' long x 39" wide.
   2. Acceptable Products: Model E-COMP-32 by LA Steelcraft

2.4 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 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

A. Install the work of this Section in strict accordance with the manufacturers' recommendations as approved by the Architect, and with the requirements of governmental agencies having jurisdiction.
B. Install equipment plumb, level, straight, square, accurately aligned, correctly located, to proper elevation, and secure.

C. Install equipment using manufacturer's supplied hardware and fasteners

D. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

E. Remove and replace damaged components that cannot be successfully repaired, as determined by Architect.

END OF SECTION 11 6820

SECTION 12 9310 - BICYCLE RACKS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide bike racks where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
   1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
   2. Installation Procedures: Submit 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.

PART 2 - PRODUCTS

2.1 GENERAL

A. Basis of Design: Wave Series Model WLBR-13 by LA Steelcraft Products, Inc., or The Rambler Multi-Capacity, 13 bike, schedule 40 pipe, flange mount including covers with center support by Huntco; powder-coat black.
   1. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01620.

2.2 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 INSTALLATION

A. Install the work of this Section in strict accordance with the Shop Drawings and manufacturer's recommendations as approved by the Architect.

END OF SECTION 12 9310

SECTION 14 4210 - VERTICAL WHEELCHAIR LIFTS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide wheelchair lifts where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit detailed drawings of fabrication, installation, anchorage, and interface with the work of other trades. Submit detailed drawings of special accessory components not included in manufacturer's product data.
4. Samples: Submit samples of proposed finishes of exposed materials.

B. Contract Closeout Submittals:
1. Operation and Maintenance manuals in accordance with requirements of Section 01 7820.
2. Manufacturer's recommended cleaning procedures.
3. Wiring diagrams.
4. Certificates of Inspection by governmental entities.

1.3 QUALITY ASSURANCE

A. Use products produced by manufacturers regularly engaged in the business of manufacturing, installing, and servicing equipment of the type required by this Section of these Specifications, and with a history of successful production acceptable to the Architect.

B. Code Compliance:
1. 2023 ASME A18.1 Safety Standard for Platform Lifts and Stairway Chairlifts.

C. Provide self-rechargeable battery power that provides sufficient power to operate platform lift for a minimum of 5 upward and downward trips. in case of loss of primary power.

1.4 SPECIAL WARRANTY

A. In addition to the warranty requirements of the Contract Documents, submit 2 original copies of a warranty from the manufacturer for materials and workmanship with an extended correction period of **2-years.**

PART 2 - PRODUCTS

2.1 WHEELCHAIR LIFT

A. Acceptable Product:
1. Basis of Design: Model GVL-OP-42 by Garaventa Lift, 800-663-6556.
2. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Capacity: 750 lbs rated capacity.

C. Mast Height: 45" maximum lifting height.

D. Platform Size and Nominal Clear Platform Dimensions:
1. Straight Through Access: 36" by 48-7/8" clear platform dimensions.

E. Platform Configuration:
1. Straight Through Access: Front and rear openings.

F. Landing Openings: Gates shall be self-closing type.
1. Gate Height: 42".
2. Platform Gate: Travels with platform and opens at lower landing.
3. Upper Landing Gate: Installed at upper landing.
4 Power Gate Operators: Automatically opens the gate when platform arrives at a landing. Will also open at landing by pressing call button. Doors shall remain open for 20 seconds minimum (11B-410.6).
a. Locations:
1. Platform Gate: Travels with platform and opens lower landing.
2. Upper Landing Gate.
b. ADA Compliant and obstruction sensitive.
c. Low voltage, 24 VDC with all wiring concealed.

G. Lift Components:
1. Machine Tower: Custom aluminum extrusion.
2. Base Frame: Structural steel.
3. Platform Side Wall Panels: 16 gauge galvanized steel sheet.
4. Side Guard Panels: 42" high mounted on platform.

H. Base Mounting at Lower Landing:
1. Pit Mount: Mount lift in pit with dimensions to meet manufacturers requirements for the platform size specified. Pit construction shall be in accordance to Section 03 3000.

I. Hydraulic Drive:
1. Drive Type: Chain hydraulic.
2. Emergency Operation: Manual device to lower platform and battery auxiliary power to raise or lower platform.

J. Safety Devices:
1. Integral safety nut assembly with safety switch.
2. Travel Speed: 10 fpm.
3. Motor: 2.0 hp.
4. Power Supply: 120V AC single phase; 60 Hz on a dedicated 20 amp circuit.

K. Platform Controls: 24V DC control circuit with the following features:
   1. Direction Control: Constant pressure rocker switch.
   2. Illuminated and audible emergency stop switch shuts off power to lift and activates audio alarm with battery backup.
   3. Keyed operation.

L. Call Station Controls: 24V DC control circuit with the following features:
   1. Direction Control: Constant pressure rocker switch.
   2. Keyed operation.
   3. Call Station Mounting:
      a. Lower: Wall mounted surface.
      b. Upper: Wall mounted surface or frame mounted.

M. Safety Devices and Features:
   1. Grounded electrical system with upper, lower, and final limit switches.
   2. Tamper resistant interlock to electrically monitor that the gate is in the closed position and the lock is engaged before lift can move from landing.
   3. Electrical disconnect shall shut off power to the lift.
   4. Under platform safety pan with five waterproof safety switches to detect obstruction under platform.

N. Finishes:
   1. Aluminum Extrusions: Champagne anodized finish.
   2. Ferrous Components: Electrostatically applied baked powder finish, fine textured; color as selected by the Architect from the manufacturer’s standard color selections.

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 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

A. Install wheelchair lifts in accordance with applicable regulatory requirements including ASME A 17.1, ASME A 18.1 and the manufacturer's written instructions.

B. Adjust all components to operate within accepted design tolerances, and lubricate equipment in accordance with the manufacturers' recommendations.
   1. Perform tests in compliance with ASME A 17.1 or A18.1 and as required by authorities having jurisdiction.

C. Upon completion of the installation, make arrangements for and secure required inspections, tests, and approvals of the completed systems. Make all changes and adjustments required without additional cost to the Owner.

3.4 DEMONSTRATION

A. Upon completion and prior to the acceptance of the work of this Section, schedule and conduct a meeting with the Owner and his personnel to train and thoroughly familiarize them with information necessary to operate and maintain the work. Include, but do not limit the training to:
   1. Use of wiring diagrams;
   2. Warranty coverage and requirements;
   3. Operation and maintenance manuals;
   4. Special tools and spare parts;
   5. Safety procedures and requirements;
   6. Manufacturer's recommended cleaning procedures;
   7. Identification systems;
   8. System operation and features including, but not limited to:
      a. Start-up;
      b. Control sequences;
      c. Shut down;
      d. Controls manipulation;
      e. Emergency procedures;
      f. Noise/vibration adjustment;
   9. System maintenance.

B. Demonstration Meeting:
   1. Demonstrate system through a minimum of 3 cycles.
   2. Prepare and execute In-Service Certification form and submit with closeout documentation.

END OF SECTION 14 4210

SECTION 21 00 00 - FIRE SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 23 00 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 building shall be fire sprinklered. Note, all Science Classrooms shall be Ordinary Hazard, Group 2.

B. Design/Calculations: The sprinkler system has been designed and sized by hydraulic calculations in accordance with 2022 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 2022 NFPA 13, paragraph 23.3.5 in all respects.

D. Coordination Drawings: Contractor shall submit coordination drawings 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.

C. Painting of exposed piping.

1.4 DESIGN CHANGES/SUBSTITUTIONS:

A. General: Design changes or substitutions of fire sprinkler system shall be submitted to Engineer for review and approved by DSA in the form of a CCD.

B. Significant changes in design or substitution of materials may require a change order, requiring resubmission to the authority having jurisdiction, as determined by the Engineer. Contractor shall bear all expenses incurred due to preparation and processing of design substitutions, up to and including submission to, and obtaining approval from, authority having jurisdiction. Refer to Section 23 00 00, 1.11, 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 Engineer and authority having jurisdiction for review and approval.

D. Contractor shall submit design or field change(s) through proper channels. Engineer shall have a minimum of 5 working days after receipt of design or field change(s) to submit to DSA. Architect and Engineer shall not be liable for any delays due to DSA review time scheduling, or Contractor's failure to identify changed areas and/or substituted materials in shop drawings and submittals.

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 2022 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 to Civil P.O.C.: Polyvinyl chloride, FM 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: Roll grooved black steel pipe, ASTM A53, Schedule 10, with roll grooved couplings and fittings. UL or FM listed. 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 2022 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 RFII 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 and electric bell complete with trim as required by the authority having jurisdiction. Provide flow switch for connection to alarm system. Provide tamper switch. UL listed. Coordinate 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: https://osfm.fire.ca.gov/what-we-do/fire-engineering-and-investigations/automatic-fire-extinguishing-systems

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 2022 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.
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. Piping through walls and footings below grade shall be sealed with Link Seal. Pipes passing between floors shall have Holdrite HydroFlame water/firestop sleeves, UL listed.
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. Pipes passing between fire rated floors shall have Holdrite HydroFlame water/firestop sleeves, UL listed.
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 NFPA No. 13 and 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 NFPA No. 13 and 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

SECTION 22 00 00 – PLUMBING

PART 1: - GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 23 00 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. Storm drain system.
4. Drain system (including condensate drain).
5. All equipment as shown or noted on the drawings or as specified.
6. Coordinate and cooperate with commission agent as required by Section 01 91 13.
7. Demolition as indicated on drawings. Where demolition is called for, remove all equipment, piping, braces, housekeeping pads, supports and related items no longer required.
8. 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. Concrete and reinforcing steel unless specifically called for on the drawings or specifications.
3. Painting unless specifically called for in the drawings or specifications.
4. Carpentry.
5. Control of circulating pumps, etc.

PART 2: - PRODUCTS

2.1 PIPING MATERIALS:

A. Sanitary Sewer:
1. Soil, Waste and Vent Piping (Non-Pressurized) - Inside Building, Within Five Feet of Building Walls to Civil P.O.C.: 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, Charlotte, Tyler. Couplings shall be heavy-duty shielded couplings, Type 304 stainless steel, with neoprene gasket, ASTM C-1540. Husky HD 2000, Clamp-All 80, Mission HeavyWeight. MG Couplings are also acceptable. Size 2" and smaller above grade may be standard weight galvanized steel, ASTM A53, with coated cast iron recessed drainage fittings, ANSI B16.12. 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.
Below Grade at Kitchens: Standard weight epoxy-coated cast iron pipe and fittings. Plain end, CISPI 301, ASTM A888. The inside of each pipe shall be reamed prior to coating to decrease the coefficient of friction. Pipe coating shall be chemically deposited zinc-phosphate pretreatment layer

followed by an electrically deposited, high-performance cathodic epoxy coating, and finally an electrically deposited, high performance anodic epoxy top coat. Pipe and fitting coatings must pass the following performance specifications per EN 877: 350 hours of salt spray testing, resistance to wastewater for 30 days at 73° F, chemical resistance from pH 2 to pH 12 for 30 days at 73° F, resistance to hot water for 24 hours at 203° F. Cutting of piping and field coating of all cut joints shall be in accordance with the manufacturer's installation guidelines. Couplings shall be heavy-duty shielded couplings, Type 304 stainless steel, with neoprene gasket, ASTM C1540. Husky HD 2000. Charlotte Edge HP Iron.

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 to Civil P.O.C.: 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 and Gas:
1. 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. For existing water systems of galvanized steel or copper, materials shall match existing.
   a. Inside Building, Within Five Feet of Building Walls, and All Above Grade to Civil P.O.C.:
      (1) Schedule 40 galvanized steel pipe, ASTM A53. 150 psi galvanized malleable iron screwed fittings, ANSI B16.3.

   -or- (2) 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, 95-5 tin-antimony solder. All nipples shall be lead-free red brass (85% 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.
   b. Outside Building - Below Grade to Civil P.O.C.:
      (1) Same as Inside Building. Galvanized steel shall have protective coating.

   -or- (2) 3" and Smaller: Schedule 80 Polyvinyl chloride (PVC), ASTM D1785, with Schedule 80 PVC solvent weld fittings, ASTM D2466 where approved by administrative authority.

   -or- (3) 4" and Larger: Polyvinyl chloride, AWWA C900, Class 150, ASTM D1784, ASTM D2241, where approved by administrative authority, cast or ductile iron fittings, AWWA C110 or C153, Class 150, with rubber ring joints, ASTM D1869.
2. Hot Water Piping:
   a. Inside Building - Above Slab: Same as Cold Water Piping - Inside Building.
   b. Outside Building or Below slab: Pre-insulated. Type L copper core. 1" foamed polyurethane insulation for less than 1" nominal pipe, 1-1/2" for 1" and larger nominal pipe. See Title 24, Part 6 "California Energy Code" for temperatures above 140ºF. Polyvinyl chloride or high density polyethylene jacket. Sealed ends. Brazed joints (1100F, min.) Fittings shall be wrought copper, with brazed joints (1100F, min.). Provide anchor points and bolster pads as required. Submit shop drawing from manufacturer showing anchor points and bolster pad locations. Perma-Pipe/Ricwil, Thermacor, Thermal Pipe Systems.
3. 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. 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) Check Valve: 2" and Smaller: Lead-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. 2-1/2" and Larger: Iron body, flanged, bronze mounted, swing check. 200 psi CWP. Stockham G-931.

(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) Plug Valve: Valves in gas piping systems must be UL or CSA listed for gas distribution. 4" and Smaller: Eccentric bronze or nickel plated semi-steel plug. Semi-steel body. Bronze bushings. Buna-N-rings. 175 psi WOG. KeyPort Valve Series 400. 2" and smaller above grade may be listed full port ball valves, except in publically accessible locations. Apollo, Jomar, Nibco. 6" and Larger: Lubricated plug cock. Cast iron or semi-steel body and plug. 200 psi WOG. Flanged. Wrench handle. Provide one operating "T" handle for underground valves. Resun R-1431.

(7) 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.

(3) Pressure Gage: Phosphor bronze tube. Bronze bushed. 1% accuracy. Cast aluminum case. 3-1/2" white dial. Adjustable pointer. Operating pressure at midscale. 1/4" NPT brass socket. Provide brass porous core pressure snubber and gage cock. Trerice, Weksler, Winters.

(4) Gage Cock: Lever handle brass cock. 1/4" NPT connections.

(5) Instrument Well: Suitable for temperature sensing element. Coordinate with supplier of temperature controls.

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, Gruvlok.
(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.
(5) Gas Pressure Reducing Valve: Capacity and pressure ratings as indicated on drawings. American Meter.
(6) Flexible Connection: Corrugated bronze or stainless steel core covered with high tensile bronze or stainless steel tubular braid. 150 psi working pressure. 2" and smaller shall have screwed connections. 2-1/2" and larger shall have flanged connections. Flexonics, Keflex.

E. Drain Piping (including Condensate): Same as inside building cold water piping.

F. 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. 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 water tight with mastic. For cold process built-up roof, material shall be 4 lb/ft^2 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. 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.

F. Outdoor Weather Barrier Mastic: Childers CP-10/11, Foster 46-50.

G. Metal Jacketing/Flashing Sealant: Childers CP-76, Foster 95-44.

H. Molded Closed Cell Vinyl (Piping Insulation Under Accessible Lavatories and Sinks): Fully molded closed cell vinyl, 1/8" thick, minimum. Thermal conductivity shall not exceed 1.17 BTU-in/hr-ft^2-ºF at an average temperature of 73ºF. 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, 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" FIP inlet ¼ turn ball angle stops with loose key, lock shield, and chrome plated copper riser (3/8" for 2-1/2 gpm and less, otherwise 1/2"). BrassCraft, Dahl, McGuire.
   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 governing authorities.
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. Three-phase motors shall be open drip-proof, NEMA B design on pumps, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction, unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors from 1 horsepower to 5 horsepower shall be the standard high efficiency type, Magnetek E-Plus. Motors 7-1/2 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. 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. Heat Pump Water Heater (WH-2): See Plumbing Fixture and Equipment Schedule on Plumbing Drawings.

C. Electric Water Heater (WH-1, 3, 4): 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. Bradford-White, A.O. Smith, American Appliance, State Industries.

D. Domestic Water Booster Pump: See Plumbing Fixture and Equipment Schedule on Plumbing Drawings.

E. Electric Drinking Fountain: Wall hung with bottle filler, see equipment schedule on plumbing drawings. Provide steel mounting brackets. Stainless steel basin. Removable grid drain. Chrome plated brass bubbler with automatic flow regulator and self-closing valve. Nonferrous evaporator. Lead solder shall not be used. Hermetic compressor with automatic reset overload protection. Air cooled condenser. Adjustable thermostat. UL listed. ARI certified. Elkay, Haws, Sunroc.

F. Circulating Pump: In line centrifugal. ECM motor. Lead free bronze body, stainless steel impeller and shaft. Mechanical seals. Carbon sleeve bearing. Integral thermal overload protection. Class F insulation. ECM

controller with Modbus or BACNet interface (coordinate required interface with Controls Contractor, Section 23 0923). Bell and Gossett.

2.5 GREASE INTERCEPTOR:

A. Polyethylene grease interceptor designed and constructed in accordance with California Code of Regulations, Title 24. 24" manholes with gas tight cover. H20 rated. See schedule on drawings for tank sizing, inlet and outlet sizing and number of manholes. Mifab.

2.6 PIPING FREEZE PROTECTION TAPE:

A. General: The self-regulating heating cable shall consist of two (2) 16 AWG nickel-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heating cable to be cut to length in the field. The heating cable shall be covered by a radiation-crosslinked, modified polyolefin dielectric jacket. To provide a ground path and to enhance the heating cable's ruggedness, the heating cable shall have a braid of tinned copper and an outer jacket of modified polyolefin. Power connection, end seal, splice, and tee kit components shall be applied in the field. Heating cable circuit shall be protected by a ground-fault device for equipment protection. Raychem XL-Trace, or equal.

B. The heating cable shall have a self-regulating factor of at least 90 percent. The self-regulation factor is defined as the percentage reduction, without thermostatic control, of the heating cable output going from 40°F pipe temperature operation to 150°F pipe temperature operation. The heating cable shall operate on line voltages of 120 volts without the use of transformers.

The heating cable for metal-pipe freeze protection shall be sized according to the table below. The required heating cable output rating is in watts per foot at 50°F. (Heating cable selection based on 1 inch fiberglass insulation on metal piping.)

Minimum Pipe Size	Ambient Temperature	
(inches)	0°F	–20°F
3 or less	5 watts	5 watts
4	5 watts	8 watts
6	8 watts	8 watts
8	8 watts	2 strips–5 watts
10	2 strips–5 watts	2 strips–8 watts

C. All heating-cable components shall be UL Listed, CSA Certified, or FM Approved for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating-cable core to expose the bus wires. Connection systems that require the installing contractor to strip the bus wires or that us crimps or terminal blocks, shall not be acceptable. All components that make an electrical connection shall be reenterable for servicing. No component shall use silicone to seal the electrical connections. An exception will be made in areas where a conduit transition is required.

D. Thermostatic Control–Line Sensing: The system shall be controlled by a line sensing thermostat, (EC-TS) set at 40°F.

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. Welded or Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100F. Welding or brazing shall be performed by a Certified Welder or 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:

Maximum Spacing*

Pipe Size (Inches)	Between Supports (ft.)		
	Copper	Sch. 40 steel	Plastic
1/2	6	6	4
3/4	6	8	4
1	6	8	4
1-1/4	6	10	4
1-1/2	6	10	4
2	10	10	4
2-1/2	10	10	4
3	10	10	4
4	10	10	4
6	10	10	4
8	10	10	4

*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 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. Pipes passing through floors shall have Holdrite HydroFlame water/firestop sleeves, UL listed.

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. Pipes passing through fire rated floors shall have Holdrite HydroFlame water/firestop sleeves, UL listed.

d. 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.

e. Thermometer Tap: Provide tee for instrument well. Minimum size of pipe surrounding well shall be 1-1/2". Mount on side of pipe.

B. Sanitary Sewer Piping:

1. General: Where inverts are not indicated, 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. The manufacturer of the pre-insulated underground hot water piping system shall instruct the installer regarding the manufacturer's required installation procedures. The manufacturer shall also provide sufficient job site inspection to ensure that the work is being accomplished in accordance with the plans, specifications and manufacturer's requirements. Upon completion of the installation, a certificate shall be furnished to the Architect by the manufacturer of the system, certifying the installation was made in accordance with his requirements and in compliance with the plans and specifications.

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.

F. Plastic Piping: Shall be cut square and assembled prior to solvent weld. Apply primer per manufacturer's recommendations. Coat male joint fully with solvent, make joint before solvent dries and wipe exterior clean.

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 PVC jacketing where exposed to view, aluminum jacketing where exposed to weather.

C. Piping Insulation Under Accessible Lavatories and Sinks: Water piping, water stops and drain piping under accessible 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 INSTALLATION OF FREEZE PROTECTION TAPE:

A. System shall be installed on the Condensate Drain piping inside the Walk-in Refrigerator and Freezer boxes. Installation shall be per manufacturer’s recommendations. Apply the heating cable linearly on the pipe after piping has been successfully leak tested. Secure the heating cable to piping with cable ties or fiberglass tape. Apply “Electric Traced” labels to the outside of the thermal insulation. After installation and before and after installing the thermal insulation, subject heating cable to testing using a 2500-Vdc Megger, Minimum insulation resistance shall be 20 megohms or greater.

B. Insulate piping with 1” thick fiberglass, similar to 3.2A above, except provide complete vapor barrier. Seal all joints and seams with vapor barrier coating in addition to the vapor barrier tape. Cover insulation with Aluminum Jacketing, seal water tight with metal jacketing/flashing sealant.

3.4 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.

3.5 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.

3.6 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.
   3. Storm Drain: 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. 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.

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.

3.7 DISINFECTION:

A. Disinfect all domestic water piping systems in accordance with 2022 CPC Section 609.10, and in accordance with administrative authority. Disinfection process shall be performed in cooperation with health department having jurisdiction and as required by applicable codes in presence of Inspector of Record (IOR). During procedure signs shall be posted at each water outlet stating, "Chlorination Do Not Drink". Contractor shall notify the IOR 48 hours prior to the need for testing so the IOR can make arrangements for the testing laboratory to collect samples and test the water. Samples shall be taken at the furthest point of each building. Contractor shall obtain a copy of the test results from the Testing laboratory and shall provide copies to the Architect, IOR and Owner before project completion. 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. Contractor shall include copy of Bacteriological Test Results at closeout with operation and maintenance manuals.

END OF SECTION

SECTION 23 00 00 - GENERAL MECHANICAL PROVISIONS

PART 1: - GENERAL

1.1 GENERAL CONDITIONS:

A. The preceding General and Special Conditions and Divisions 00 and 01 requirements shall form a part of this Section with the same force and effect as though repeated here. The provisions of this Section shall apply to all of the Sections of Divisions 21, 22 and 23 of these Specifications and shall be considered a part of these sections.

1.2 CODES AND REGULATIONS:

A. All work and materials shall be in full accordance with current rules and regulations of all 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:
1. California Code of Regulations (CCR):
    a. Title 8, Industrial Relations
    b. Title 24, Part 1, Administrative Regulations, 2025 Edition
    c. Title 24, Part 6, California Energy Code, 2022 Edition
    d. Title 24, Part 11, California Green Building Code, 2022 Edition
2. California Building Code - CBC - 2022
3. California Mechanical Code - CMC - 2022
4. California Plumbing Code - CPC - 2022
5. California Fire Code - CFC - 2022
6. California Electrical Code - CEC - 2022
7. Air Diffusion Council - ADC
8. American Gas Association - AGA
9. Air Movement and Control Association - AMCA
10. American National Standards Institute - ANSI
11. Air Conditioning and Refrigeration Institute - ARI
12. American Society of Heating, Refrigerating, and Air Conditioning Engineers - ASHRAE
13. American Society of Mechanical Engineers - ASME
14. American Society for Testing and Materials - ASTM
15. American Water Works Association - AWWA
16. Cast Iron Soil Pipe Institute - CISPI
17. National Electrical Manufacturers Association - NEMA
18. National Fire Protection Association - NFPA
19. National Sanitation Foundation - NSF
20. Occupational Safety and Health Act - OSHA
21. Plumbing and Drainage Institute - PDI
22. Sheet Metal and Air Conditioning Contractors National Association - SMACNA
23. Underwriters' Laboratory - UL

1.3 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. Permits for equipment connected to a particular system are to be considered as part of the work included under each system. All charges or fees for service connections, meters, etc. shall be included in the work.

1.4 COORDINATION OF WORK:

A. 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. Verify the proper voltage and phase of all equipment with the electrical plans. 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 Architect and 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.

B. Mandatory Coordination and Shop Drawings:

1. Prepare or have prepared high level detailed Shop Drawings in plan view, with cross-sections as necessary, indicating the proposed installation plan for all HVAC, mechanical, fire sprinkler, and plumbing installations for the project. These Drawings should depict actual elevations and linear dimensions, as well as all routing changes, transitions, major offsets, deck and structural attachments deemed necessary to accomplish the installation. Individual Shop Drawings may be prepared for each trade working within the designated space or area; however, the coordination of the consolidated installation shall remain the responsibility of the Contractor. These Shop Drawings shall be provided to each Subcontractor having Work in each area for coordination. Any fittings, offsets or other changes due to coordination shall be at no additional cost to Owner.
2. Whereas the Drawings are diagrammatic, showing only the general arrangement of the systems, Contractor shall have responsibility for the fitting of materials and equipment to other parts of the equipment and structure, and to make adjustments as necessary or required to resolve space problems, preserve service room, and avoid architectural and structural elements and the Work of other trades. Contractor may be required to identify certain areas to relocate installations within the spaces depicted on the Drawings, e.g., ductwork and/or piping may be shifted within the space shown to accommodate other systems. Such functional relocations shall not be deemed a change to the requirements of the Contract. In the event a major re-routing of a system appears necessary, Contractor shall prepare and submit for approval, Shop Drawings of the proposed rearrangement.
3. Because of the diagrammatic nature and small scale of the Drawings, all necessary offsets, adjustments, and transitions required for the complete installation are not shown. Contractor shall carefully investigate the conditions affecting all the Work and shall arrange such Work accordingly, furnishing such fittings, equipment, valves, accessories, offsets, etc., as may be required, regardless of size or cost, to meet such conditions, at no additional cost to the Owner.
4. Coordination changes are not design changes and shall be provided at no additional cost to Owner. Any guidance, drawing or clarification issued by the Architect or Engineer to assist the Contractor or their sub-contractors in their coordination during construction are not design changes and shall be provided at no additional cost to Owner.
5. Resolve differences or disputes between subcontractors and materials suppliers concerning coordination, interference, or extent of work between sections. The Contractor's decisions, if consistent with the Contract Documents, shall be final. The Architect and their Consultants are not required to coordinate work between sections and will not do so. Any changes required that affect the design intent shall be presented to and approved by the Architect and Engineer of Record.
6. The coordinated Shop Drawings must be signed off by HVAC, Plumbing, Fire Sprinkler, Electrical, Framing, Ceiling Installation, and Data and Low Voltage Subcontractors.
7. The signed off Shop Drawings shall be submitted to the Owner's Representative for review and approval prior to commencement of installation.
8. Provide reviewed Shop Drawings to each Subcontractor having Work in each area.

1.5 GUARANTEE:

A. Guarantee shall be in accordance with the General Conditions. 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 Architect. Equipment that is started and operated prior to acceptance shall have the guarantee extended to cover that period. Owner guarantee shall start at acceptance.

1.6 QUIETNESS:

A. Piping, ductwork and equipment shall be arranged and supported so that vibration is a minimum and is not transmitted to the structure.

1.7 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.

1.8 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.

1.9 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.

1.10 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.

1.11 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 (this includes deferred approval items). Material or equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution.
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. Drawings shall be submitted in both hard copy and electronic form, electronic files shall be in their native format (i.e. DWG for AutoCAD, RVT for Revit, etc).
5. 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: Substitutions affecting ——————————————→ DSA review and approval, as a CCD.
1. Manufacturers and model numbers listed in the specifications or on the drawings establish the size, standard of quality, features and function selected by the Engineer for this Project. Alternate manufacturers may be submitted for review by the Engineer as allowed by Section 01 33 00 "Submittal Procedures" or Section 01 25 00 "Substitution Procedures", as applicable. If the alternate manufacturers are not approved, then the Contractor shall submit product specified. Calculations and other detailed data indicating how the item was selected shall be included.
2. Due to the complexity of mechanical equipment, features and functions, where equipment is scheduled on the drawings, any equipment submitted other than scheduled equipment is considered a substitution, and shall comply with the requirements of Section 01 25 00 "Substitution Procedures". It is understood that because of this complexity, subsequent reviews of Substitution Requests may be unavoidable. The Mechanical Engineer waives the fees identified in Section 01 25 00, for the initial and first subsequent review of a Substitution Request for mechanical equipment scheduled on the Drawings.
3. 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.

1.12 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.

1.13 SCHEDULING OF WORK:

A. All work shall be scheduled subject to the review of the Architect, 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.

1.14 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 Architect.

1.15 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 trenches 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. Native soil may be used where allowed by Geotechnical (Soils) Report. Where native soil is used, trenching for gravity drain pipe shall be done using a laser-level and trencher.
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.

1.16 PROTECTIVE COATING FOR UNDERGROUND PIPING:

A. All metal pipe below grade 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. Johns-Manville. Protective coating shall be extended 6" above surrounding grade.

1.17 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. Key and cylinder lock (except quick-opening type for Emergency Gas Shutoff Valve). 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"
Fire/smoke damper, VAV box, coil	20" x 24"

1.18 HOUSEKEEPING PAD: See Structural Drawings. Where not shown on Structural Drawings, provide per paragraph A.

A. Housekeeping pads not shown on Structural Drawing 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. The pad shall have #4 reinforcing bars at 12" on center, each way, located at the mid-depth of the pad.

1.19 CONCRETE ANCHORS:

A. Shall be 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 as shown on drawings. 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 318-19, Chapter 17, and the anchor’s ICC or IAPMO evaluation report. Hilti, Powers, Red Head.

1.20 EQUIPMENT ANCHORING:

A. All equipment shall be securely anchored in accordance with ASCE 07-16, Chapter 13, as amended by CBC Section 1617A.1. All equipment mounted on concrete shall be secured with a concrete anchor as shown on drawings at each mounting point.

1.21 SEISMIC SUPPORT AND RESTRAINT DESIGN SERVICE:

A. All mechanical systems (equipment, ductwork, piping, etc.) shall be provided with supports and seismic restraints in accordance with ASCE 07-16, Chapter 13, as amended by CBC Section 1617A.1. Brace spacing shall be reduced by 50% for cast iron, plastic, no-hub, or other non-ductile piping.

B. Submit seismic shop drawings for Design Team review.

1.22 ASBESTOS CONTAINING MATERIALS AND ASBESTOS REMOVAL:

A. No materials or material coatings containing asbestos shall be allowed on this project.

B. All asbestos removal shall be by Owner. Asbestos is to be removed before the work is started. If the Contractor discovers asbestos which has not been removed, the Contractor shall immediately cease work in that area and promptly notify the Owner.

1.23 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. Deliver to Owner through Architect.

1.24 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.

1.25 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.

1.26 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. Electronic O & M's shall comply with the Electronic submittal requirements in this Section.

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.

1.27 RECORD DRAWINGS:

A. The Contractor shall obtain one set of blue line 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, underfloor duct, etc. within the building shall be recorded by offset distances from building walls. As part of the Contractor's overhead expense, request a full set of reproducible drawings to transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review.

PART 2: - PRODUCTS (not used)

PART 3: - EXECUTION (not used)

END OF SECTION

SECTION 23 00 01 - HEATING, VENTILATING AND AIR CONDITIONING

PART 1: - GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions, Section 23 00 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. Furnish motor starters except where motor control centers are used. Coordinate with Division 26.
3. Circulating water system.
4. Refrigeration system.
5. System energy balance.
6. Coordinate with Section 23 09 23 (Direct Digital Control and Energy Management System) regarding location and installation of system sensors and to provide simultaneous start-up.
7. Coordinate and cooperate with commission agent as required by Section 01 91 13.
8. 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, motor starters in motor control centers, disconnect switches and installation of all starters are included in the Electrical Section, unless otherwise noted.
2. Connection of gas, condensate drains and domestic water to equipment.
3. Concrete and reinforcing steel unless specifically called for in the drawings or specifications.
4. Painting unless specifically called for in the drawings or specifications.
5. Carpentry.
6. Direct Digital Control and Energy Management System (DDC/EMS).

PART 2: - PRODUCTS

2.1 PIPING MATERIALS:

A. Hot or Chilled Water Piping:
1. Above Grade:
a. 2" and Smaller: Schedule 40 black steel pipe, ASTM A53. 150 psi black malleable iron screwed fittings, ANSI B16.3.
b. 2-1/2" Through 4": Screwed pipe as above -OR- welded or grooved pipe as below.
c. 6" and Larger: Schedule 40 black steel pipe, ASTM A53. Standard weight carbon steel welding fittings, long radius ells, ANSI B16.9. Joints may be grooved pipe unions, EPDM gaskets. Grinnell, Gruvlok, Victaulic.
2. Underground Chilled Water Piping: Pre-insulated. Schedule 40 PVC core. 1” (min) foamed polyurethane insulation. HDPE jacket. Sealed ends. Fittings shall be Schedule 80 PVC, solvent welded. Field joints shall be field insulated with foamed polyurethane, applied using factory mold. Use pressure sensitive tape for closures. PVC fittings shall be bare and thrust blocked.
3. Underground Hot Water Piping:

a. General: Underground hot water lines shall be Ferro-Therm, as manufactured by Thermacor Process. All straight sections, fittings and other accessories shall be factory-fabricated to job dimensions. Each system layout shall be computer-analyzed by the piping system manufacturer to determine stress on the carrier pipe and anticipated thermal movement of the service pipe. The system design shall be in conformance with ANSI B31.1. Provide manufacturer's shop drawings with dimensioned piping layout and details of all expansion fittings, elbows, building entry points and all other pertinent information needed to verify that the type of materials being offered is in accordance with the specifications.

b. Jacket: Seamless high density polyethylene (HDPE) in accordance with ASTM D1248, Type 3, Class C. Minimum jacket thickness shall be 125 mils.

c. Carrier Pipe: ASTM A-53, Grade B, electric-resistance welded black steel with beveled ends for field welded joints. Schedule 40. Butt welding fittings shall conform to ANSI Standard B16.9.

d. Insulation: Polyurethane foam completely filling the annular space between the carrier pipe and the outer jacket to a minimum thickness of 1.38 inch. The in-place density shall be 2 pounds per cubic foot; the thermal conductivity factor shall be 0.15 BTU/(Hr.)(Sq. Ft.)(°F/In.); and shall have a closed cell content of 90%. Exposed insulation at unit ends shall be sealed with factory applied high temperature elastomer vapor barrier sealant.

e. Fittings: Fittings shall be factory fabricated and preinsulated with polyurethane foam insulation. The insulation shall be protected with a 1-piece, seamless, molded HDPE jacket of the same type, thickness and quality as that of the straight units of preinsulated pipe. Field fabrication, alteration or insulation of fittings is not permitted.

f. Expansion Fittings and Elbows: Prefabricated expansion fittings, elbows and tees shall be furnished and installed where shown. Preinsulated fittings that must provide compensation for pipe expansion and/or contraction shall be externally insulated with flexible polyurethane foam insulation. The straight units adjoining expansion fittings shall also be insulated with flexible polyurethane foam insulation to the extent shown on the drawings. Expansion fittings and elbows shall be properly designed in accordance with stress limits indicated by ANSI B31.1 Code for Pressure Piping. The pipe manufacturer shall furnish pipe stress calculations and expansion details stamped by a registered professional engineer showing that the piping design meets this code.

4. Valves and Specialties:

a. Valves:

(1) General: Manufacturer's model numbers are listed to complete description. Equivalent models of Crane, Milwaukee, Nibco, Stockham, Walworth, as well as Grinnell, Gruvlok and Victaulic for grooved joint systems, 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.

(2) Gate Valve: Provide 2" extension necks at insulated pipes, where required. 2" and Smaller: All bronze. Rising stem. Union bonnet. Wedge disk. Screwed connection. Malleable iron handwheel. Class 125. Nibco T-124. 2-1/2" and Larger: Iron body, bronze mounted. Non-rising stem. Resilient wedge. Class 125. Flanged or AWWA hub end as applicable. Nibco F-619-RWS. Underground valves shall have square operating nut. Provide one operating "T" handle for underground valves.

(3) Butterfly Valve: Iron threaded lug body. Aluminum bronze disk. O-ring seals. Resilient, removable seat. 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. Demco Series NE, Grinnell, Stockham.

(4) Plug Valve: Eccentric bronze or nickel plated semi-steel plug, semi-steel body, bronze bushings, Buna-N-rings. 175 psi WOG. KeyPort Valve Series 400.

(5) Check Valve: Non-slam, lift type. Replaceable bronze seat, disk and bushings. Stainless steel helical spring. Disk guided at top and bottom. Flow area through valve shall exceed cross sectional area of pipe. 150 psi WOG. CPV, Mueller Steam Specialty. 2" and Smaller: Shall be screwed brass with hand lapped bronze disk. 2-1/2" and Larger: Shall be iron body, wafer or flanged with resilient Buna-N or TFE facing on seat.

(6) Ball Valve: Full port. Bronze body, cap, stem, disk and ball. Screwed connection. Lever handle. TFE seat. O-ring seals. 300 psi WOG. Apollo, Nibco, Jomar.

(7) Globe Valve: All bronze. Renewable TFE disk. Screwed connection. Malleable iron handwheel. Union bonnet. Class 150. Stockham B-22.

(8) Valve Box: Pre-cast reinforced concrete. Cast iron lid marked for services. Christy F22 in foot traffic areas; G5 in roadways.

b. Instruments:

(1) Pressure Gage: Phosphor bronze tube. Bronze bushed. 1% accuracy. Cast aluminum case. 3-1/2" white dial. Adjustable pointer. Operating pressure at midscale. 1/4" NPT brass socket. Provide brass porous core pressure snubber and gage cock. Trerice, Weksler, Winters.

(2) Thermometer: 3" dial. Stainless steel case. Back or bottom connected as required. 1/2" NPT. 20-240ºF, 2ºF divisions for hot water, 25-125ºF, 2ºF divisions for chilled water. 2" insertion length. Allowance to be made for insulation thickness. Marshalltown, Moeller, Taylor, Tel Tru, Winters.

(3) Thermometer Well: Brass well. Suitable for 3" dial thermometer above. Provide 2" extension at insulated pipes.

(4) Gage Cock: Lever handle brass cock. 1/4" NPT connections. Provide 2" extension at insulated pipes.

(5) Instrument Well: Suitable for temperature sensing element. Coordinate with supplier of temperature controls.

(6) Flow Switch: Paddle type. McDonnell No. FS4-3.

c. Miscellaneous Specialties:

(1) Pressure Relief Valve: ASME rated fully automatic, reseating pressure relief valve sized in accordance with energy input. Watts.

(2) Union: 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi. Grinnell. Size 2-1/2" and Larger: Grooved pipe, synthetic gasket, malleable iron housing. Victaulic Style 77, type "E" gasket, Grinnell.

(3) Combination Reducing/Relief Valve: Iron body. Diaphragm operated. Brass internal parts. Reducing valve shall have a built-in strainer and check valve and have a field adjustable range of 10-25 psi and a 125 psi maximum working pressure. Relief valve shall be set at 30 psi. Bell and Gossett No. F-3.

(4) Balancing Cock: Calibrated all bronze balancing/shutoff valve or cock. Screwed connections. Memory stop. Position indicator. Drain connection. Taps for differential pressure gage, with check valves or shutoffs. 125 psi working pressure. Internal seals. Preformed insulation block. Armstrong, FlowSet by Flow Design, Inc., Grinnell, Tour and Andersson, Victaulic.

(5) Strainer: "Y" type, 125 psi. Machined seats. Stainless steel screens. Provide gate valve blowoff with hose threads. Bailey, Mueller Steam Specialty.
2" and Smaller: Screwed bronze body. Perforation size 0.057".
2-1/2" and Larger: Flanged iron body, perforation size as follows:

Pipe Size	Perforation Dia.
2-1/2" - 3"	1/16"
4" - 6"	3/32"
8" and Larger	1/8"

(6) Dielectric Coupling: Insulating union, flange or waterway fitting rated for 250 psig. EPCO, Clearflow.

(7) Suction Diffuser: Cast iron angle type body with inlet vanes and combination diffuser/strainer/orifice cylinder with 3/16" openings. Provide fine mesh start-up strainer (to be removed after 30 days of operation). Strainer free area to be not less than five times the sectional area of pump connection. Adjustable support foot, drain tapping and gage tapping. Bell and Gossett, Taco, Thrush.

(8) Expansion Tank: Pressurized diaphragm type or bladder type, as shown on drawings. Welded steel, ASME code construction with ASME stamp and certification, 125 psi, 240ºF. Sealed elastomer diaphragm or heavy duty butyl bladder. Pre-charged with air to initial fill pressure of system. Base or saddle as required for mounting. Removable access cover for bladder type. Sight glass for diaphragm type (hot water service only). Amtrol, Taco.

(9) Flexible Connection: 2" and Smaller: Screwed connection. Corrugated bronze core covered with high tensile bronze tubular braid. 150 psi working pressure. Flexonics, Keflex. 2-1/2" and Larger: Contoured, molded Teflon bellows. Minimum of three convolutions. Monel reinforcing rings. Limit bolts. Flanged connection. 100 psi working pressure. Belmont, Resistoflex. -Or- Multiple laminations of 321 stainless steel. 150 psi working pressure. Limit bolts. Flanged connection. Hyspan Series 5500.

(10) Air/Dirt Separator: Full flow coalescing type combination air eliminator and dirt separator. Separator shall be fabricated steel, rated for 150 psig working pressure, stamped and registered in accordance with ASME Section VIII, Division 1 for unfired pressure vessels, and include two equal chambers above and below the inlet / outlet nozzles. Unit shall include internal elements filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100% free air, 100% entrained air, and 99.6% dissolved air at the installed location. The elements must consist of a copper core tube with continuous wound copper medium permanently affixed to the core. Internal coalescing elements consisting of plastic, perforated steel plate/tubes or loosely filled steel rings will not be accepted. Dirt separation efficiency shall be a minimum of 80% of all particles 30 micron and larger within 100 passes. Basis of design for the air eliminator / dirt separator shall be the Spirovent® Series VDT or VHT as manufactured by Spirotherm, Inc., Glendale Heights, Illinois or approved equal as noted*. Optional Series VDN or VHN by Spirotherm, Inc. shall include removable lower head for internal inspection if so noted on the drawings and schedule.

B. Refrigerant Piping: Hard drawn Type ACR copper, dried and capped, ASTM B280. Wrought copper fittings, silver alloy brazed, 1100ºF, Silfos.

C. 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, Anvil, Unistrut.

b. Insulation Support: Calcium silicate insulation, 100 psi, or heavy density fiberglass, 100 psi. Insulation thickness equal to adjoining pipe insulation. Steel support shield or saddle. Provide vapor barrier for chilled water piping. Insulation and/or vapor barrier shall extend 1" beyond steel support. Pipe hanger in accordance with paragraph 1 above. Increase hanger size per manufacturer's recommendation. B-Line, Pipe Shields, Inc., Uni-Grip.

c. 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.

d. 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: 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. 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-ºF at a mean temperature of 50ºF. 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. 1" thickness for chilled water piping. For hot water piping 140ºF and less, thickness shall be 1" for pipe sizes less than 1", 1-1/2" thickness for pipe sizes 1" and larger. For hot water piping over 140ºF, thickness shall be 1-1/2" for pipe sizes less than 1-1/2", 2" thickness for pipe sizes 1-1/2" and larger. CSG Insulation Corp., Knauf, Johns-Manville, Owens-Corning. See Title 24, Part 6 "California Energy Code" for temperatures above 250ºF.

C. Fiberglass Blanket: Unfaced, 1-1/2" thick. Thermal conductivity shall not exceed 0.25 Btu-in/hr-ft2-ºF at a mean temperature of 50ºF. 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. Reinforcing Mesh: 10 x 10 strands per square inch. Polyester or fiberglass. Mast-a-Fab, Vimasco Elastafab or Childers Chil Glas #10.

F. Vapor Barrier Coating: Childers CP-34, Foster 30-65. Permeance shall be 0.08 perms or less at 45 mils dry as tested by ASTM F1249.

G. Lagging Adhesive: Childers CP-50A MV1, Foster 30-36.

H. 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.

I. Outdoor Weather Barrier Mastic: Childers CP-10/11, Foster 46-50.

J. Metal Jacketing/Flashing Sealant: Childers CP-76, Foster 95-44.

K. Insulating Tape: Ground virgin cork and synthetic elastomeric. Black, odorless, and non-toxic. K factor 0.43 Btu-in/hr-ft2-ºF or less. Non-shrinking. For outdoor use, provide protective finish by same manufacturer. Halstead.

L. Foamed Plastic: Rubber based elastomeric preformed pipe insulation. Thermal conductivity shall not exceed 0.27 Btu-in/hr-ft2-ºF at a mean temperature of 70ºF. 1/2" thick. Provide adhesive 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).
1. Moisture Bearing Exhaust Ductwork: Exhaust ductwork bearing moisture such as exhaust ducts from showers, dishwashers, clothes driers, etc. shall be constructed of aluminum sheets (unless shown otherwise on drawings), with gage and construction to match SMACNA Standard for pressure required.
2. Grease Bearing Exhaust Ductwork: Exhaust ducts from Type I grease hoods shall be constructed in accordance with Chapter 5 of the California Mechanical Code with 16 gage galvanized steel or 18 gage stainless steel. All joints shall be made with a continuous weld. Exposed ducts shall be stainless steel.

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-ft^2-ºF at a mean temperature of 75ºF. Seamless metalized reinforced polyester vapor barrier jacket. 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. Duct shall be capable of continuous operation at 1-1/2" of positive water static pressure and 4,000 ft/min air velocity. Steel connection collars. Duct shall comply with NFPA 90A. JP Lamborn.

D. Duct Sealants: All Joints Exposed to Weather: Sealant shall be G.E. "Silglaze II" or Silimax Multipurpose Silicone Sealant, without substitution. Joints Not Exposed to Weather: Fiber reinforced. White in color. Design Polymerics DP1030, Hardcast Versa-Grip 181, Hardcast CCWI-181. Joints Not Exposed to Weather and Exposed to View in Finished Areas: Non fibrated. Gray in color. Foster 32-19, Childers CP-146, Design Polymerics DP 1010, or United Duct Sealer WB.

E. Spiral Wound Metal Ductwork: Spiral wound factory fabricated galvanized steel, gages in accordance with the CMC. All fittings shall be factory fabricated. Fittings exposed to view shall have all seams fully welded. Tees and laterals shall be conical type. Connections to plenums shall be with bell-mouth fittings. 12" and smaller ells shall be two piece die-stamped. Ells larger than 12" shall be five piece. McGill Airflow. Shop fabricated fittings are not acceptable.

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: All 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.

F. Fire/Smoke Damper: California State Fire Marshal approved. UL listed and labeled indicating fire rating. Hour rating as required by the rating of the wall, ceiling, floor, etc. in which it is installed. Combination fire/smoke dampers shall have normally-closed, non-stall factory electric actuator rated for 250ºF (min.) and shall be Leakage Class II.

G. Duct Access Door:
1. Rectangular: Insulated double wall door. Full piano hinge. Cam latch. Pressure rating to match application. Air Balance, Ductmate.
2. Round: Three layers of stamped steel. Inside panel shall consist of two layers of metal which are spotwelded together along the rim, encapsulating high density fiberglass insulation (25/50 rated). Closed cell neoprene gasket bonded to the inside of the door. Zinc plated conical springs installed between the inner and outer door. Polypropylene molded knobs with threaded metal inserts. Knobs shall be easily turned by hand and shall be UL94HB listed. Zinc plated carriage bolts, clinched and sealed to the inner door. Provide self adhesive template for the exact size of duct opening. Pressure rating to match application. Ductmate.

H. Kitchen Hood:
1. General: Factory fabricated in accordance with CMC Chapter 5 and State codes. Install with bottom of hood 48" above cooking surface. UL labeled. Captiveaire.
2. Materials: Unless otherwise noted, all visible elements of the hood shall be constructed of stainless steel, 18 gage, type 304, with a No. 4 polished finish. All seams shall have a liquid tight, continuous weld, ground smooth and polished. Provide factory stainless steel enclosure panels.
3. Filters: Filters shall be fixed baffle type. 20 gage stainless steel construction. Filters shall be furnished with handles. Blank panels shall be installed where required to symmetrically space filters. 20 gage full length stainless steel filter rack with continuous, removable, stainless steel grease trough.
4. Lights: UL listed vapor proof LED lights. Conduit and conductors shall be pre-wired to a J-box on top of canopy.

I. Sound Trap:
1. General: Dimensions as shown on plans. 22-gage galvanized steel construction suitable for a differential air pressure of 8" of water. Filler material shall be in accordance with NFPA 90A.

Maximum pressure drop as scheduled. Air flow measurements shall be made in accordance with applicable portions of ADC, AMCA and ASME airflow test codes. BRD, Buensod-Agitair, Environmental Elements Corp., Industrial Acoustics Company, Vibro-Acoustics.

2. Sound Performance Data: The dynamic insertion loss and self-generated noise levels shall meet or better the published sound data of the sound traps which were used as the basis of design. Acoustic ratings shall be determined in a test facility which provides for airflow in both directions. The test set-up and procedure shall be such that all effects due to end reflection, directivity, flanking transmission, standing waves and test chamber sound absorption are eliminated. Acoustic ratings shall include dynamic insertion loss and self-generated noise levels for each octave band both for forward flow (air and noise in same direction) and reverse flow (air and noise in opposite directions) with air flow of at least 2000 fpm entering face velocity. Ratings shall be certified by an independent testing laboratory.

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 75ºF shall not exceed indicated value. 3/4 lb/ft^3 or 1 lb/ft^3, R-6 where ductwork is within the building thermal insulation envelope. 3/4 lb/ft^3 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 75ºF 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.

E. Fire Resistive Duct Wrap: Nominal 1-1/2” thick, 6 lb/ft3 high-temperature fiber blanket thermal insulation encapsulated in a fiberglass-reinforced aluminized polyester foil. Grease Duct Listing Standards (Double Wrap) ASTM E 2336 / ICC-ES AC101. Ventilation Duct Listing Standard (Single Wrap) – ISO 6944. 3M Fire Barrier Duct Wrap 615+.

2.6 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. 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.
3. Ratings:
   a. Gas: Gas burning equipment shall be furnished with 100% safety gas shut-off, intermittent pilot ignition, and be CSA (US) certified, except that boilers shall be CSA (US) certified or UL listed.
   b. 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 governing authorities.
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 (note that some accessories may require a separate 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, 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 open drip proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Motors in a fan air stream shall be TEFC or TEAO. Vertical motors outdoors shall be ODP or TEFC and 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.
6. Fan Selection - 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.
7. 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.
8. Screens: All duct or louver openings to the outside shall be covered with 1/2", 16-gage, galvanized wire mesh screen.
9. 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.

10. Sound Ratings: Shall be in accordance with ASHRAE 36 - 72. Sound ratings shall not exceed scheduled values.
11. 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.
12. Coils:
    a. Construction: Copper tube. Copper or aluminum 0.0075" min. thickness fins hydraulically or mechanically bonded to tube. 16-gage galvanized steel rigid channel coil casing. Rated working pressure 200 psig min. All coils shall have connections at the same end. Wherever two or more coils are being controlled by a single control valve, each coil shall be installed with a separate balancing cock and a Pete's Plug at each outlet.
    b. Capacity: Ratings certified by ARI in accordance with ARI Standard 410. Cooling coil face velocity shall not exceed manufacturer's published ratings or 600 fpm. Heating coil face velocity shall not exceed 1000 fpm. Include coil selection calculations in shop drawings.
    c. Hot or Chilled Water Coils: Copper or cast iron headers, brazed or spun to tube. Tube wall minimum thickness 0.024". 10 fins/inch maximum.
    d. Direct Expansion Coils: Copper suction header silver brazed to tubes, distributing tubes and expansion valve. Working pressure 250 psig minimum. 10 fins/inch maximum.

B. Modular Heat Pump Chiller:
1. General: Trane Thermafit modular heat pump systems consist of individual modules that are assembled on site. Each module is completely factory wired and tested prior to shipment. Each module includes vapor injection compressors, brazed plate heat exchangers, refrigerant-to-air coil, and controls. The frames and panels are constructed of powder coated, formed galvanized sheet metal. The panels are easily removable for servicing via stainless steel fasteners and retaining clips.
2. Modes of Operation: Model MAS can operate in four modes: cooling mode, heating mode, heat recovery mode and defrost mode. Heat recovery applications can control either a chilled fluid or hot fluid setpoint. When controlling a chilled water setpoint, the primary function of the unit is to provide cooling and condenser heat is a byproduct used to satisfy heating loads. When controlling a hot water setpoint, the unit sources energy from another loop and the primary function is heating. The modular heat recovery chiller system is equipped with a brazed plate evaporator and a condenser in each module each with a thermal dispersion flow switch plus valves and controls for heat recovery operation. The recovered energy is delivered to the chilled or hot fluid loop by diverting the compressor refrigerant discharge into a water-cooled heat exchanger instead of into the air-cooled condenser.
   Cooling Mode: the brazed plate evaporator is the energy source for the refrigeration circuit, absorbing heat from the chilled water. The refrigerant-to-air coil is the energy sink, rejecting heat to the ambient air. In this mode, the MAS has the same operation as an air-cooled chiller.
   Heating Mode: the refrigerant-to-air coil is the energy source in the circuit, absorbing heat from the outdoor air. The brazed plate condenser is the energy sink in the circuit, rejecting heat to the hot water circuit.
   Defrost Cycle: the refrigeration circuit operates in reverse, thereby using heat energy to melt ice that has built up on the outdoor air coil. The heat energy for defrost is extracted from the heating fluid loop. Modules will automatically enter defrost mode when ambient temperatures are below 47°F and there is frost accumulation on outdoor air coil. Trane’s intelligent control algorithm minimizes the quantity of modules allowed to defrost to reduce impact on heating

performance. Modules can operate independently in different modes to maintain system setpoints.

3. Factory Refrigerant Charge: Units will ship with a full operating charge of oil and R-454B refrigerant.
4. Refrigeration Circuits: Each chiller module has one independent refrigeration circuit with hermetically sealed scroll compressors manifolded in tandem. The refrigerant circuit includes Schrader service valves on suction, discharge, and liquid lines, liquid sight glass with moisture indicator and filter dryer. Refrigerant piping is insulated with ¾ inch closed cell insulation on the suction lines.
5. Evaporator: The Thermafit chillers use a single circuit, brazed plate evaporator on each module constructed of 316 stainless steel plates and copper brazing. The supply and return fluid piping connections to each evaporator include a manual isolation valve to allow servicing of each module individually while the remaining modules continue to operate. The fluid connections to each evaporator use roll grooved couplings for service convenience and ease of installation. Each evaporator is insulated with ¾ inch closed cell insulation. The maximum refrigerant working pressure is 650 psi. The maximum fluid side working pressure is 450 psi. Condenser piping fluid velocity cannot exceed 10 fps at any point in the system.
6. Condenser: The Thermafit chillers use a single circuit, brazed plate condenser on each module constructed of 316 stainless steel plates and copper brazing. The supply and return fluid piping connections to each condenser include a manual isolation valve to allow servicing of each module individually while the remaining modules continue to operate. The fluid connections to each condenser use roll grooved couplings for service convenience and ease of installation. Each condenser is insulated with ¾ inch closed cell insulation. The refrigerant maximum working pressure is 650 psi. The maximum fluid side working pressure is 450 psi. Condenser piping fluid velocity cannot exceed 10 fps at any point in the system.
7. Fluid-Strainers: A 40-mesh industrial grade filter strainer shall be factory installed between the header system and each brazed plate heat exchanger. The strainer shall be serviceable by isolation valves that permit each strainer to be removed and cleaned without shutting down fluid flow or power to the entire system and allowing the remaining modules to continue to operate.
8. Integral Hydronic Headers: The fluid piping shall be Schedule 10 steel with insulated, closed cell pipe insulation to prevent condensation. The chiller shall have service valves for the independent isolation of each module, without affecting the fluid flow to the remaining modules. Each chiller module shall connect to the adjacent module using Victaulic type roll grooved steel couplings and neoprene gaskets. This minimizes field piping, and since modules have equal pressure drops, flow rates self- balance without additional field intervention.
9. Electronic Isolation Valves: Each branch line includes a manual inlet and an electronic discharge butterfly valve that allows system flow to each active module to match the system's heating or cooling requirements. By isolating individual modules that are not operating, the hydronic system can have variable primary flow. The valves are the slow opening type to minimize the sudden change in flow to the previously active modules. The valves have a minimum opening cycle time of 35 seconds between the fully closed and open position and have roll grooved connections. The valves have a minimum close off pressure of not less than 75 psi and are rated for a maximum working pressure of 300 psi. The actuators are rated for 24 Vac.
10. Variable Flow: These modules are designed for variable flow operation. There are several system considerations that should be evaluated to ensure reliable operation. Please refer to Application Guide - Modular Chillers in Variable Primary Flow Chilled Water Systems (PKG-APG001C-EN) for additional information.
11. Air Coils and Fans: The air coils have aluminum fins mechanically bonded to copper tubes that function as an evaporator or condenser depending on the operational mode. The coils are factory tested to a minimum of 600 psig. The air coil fan motors are maintenance free, highly efficient Electronically Commutated Motors (ECM) with energy reduction capabilities of up to 35%. The fan motors vary speed to maintain the refrigeration head pressure in cooling mode.
12. Drain Pan: A sloped drain pan collects water from the refrigerant-to-air coil during defrost mode. There is one drain connection per module that should be field piped to a suitable drain to

eliminate water and ice buildup near the unit. Field heat tracing may be required for drain pan and condensate lines in colder climates.

13. Compressor: The Thermafit MAS module uses two hermetically sealed, enhanced vapor injection scroll compressors on the refrigeration circuit for greater heating performance at low ambient conditions. This includes oil level sight glass, suction gas-cooled motor with solid-state sensors in the windings for thermal overload protection, and circuit breaker protection. There shall be two independent compressors manifolded together on a single refrigerant circuit per module. Compressors shall be mounted to the heavy gauge steel frame with rubber-in-shear vibration isolators.
14. Unit Controls: Each module includes a microprocessor controller, and the dedicated primary controller communicates with the secondary controllers in each module via a local network communications protocol. The primary controller includes a phase monitor to protect against low voltage, phase unbalance, phase loss, and phase reversal conditions. The secondary controller monitors key performance parameters for its module and sends real-time information to the primary controller. The primary controller monitors the performance of the modular chiller system, activating and deactivating modules as needed to maintain the leaving fluid temperature for the chiller. The distributed control system allows all secondary modules to operate in standalone mode if the system-controlled temperature sensor has failed or if the primary/secondary communication has been lost. When in stand-alone mode, each module runs independently, and controls temperature based on its local temperature sensors. Stand-alone is a fail-safe mode rather than an intended mode. Thus, modules will operate temporarily in this mode until normal primary/secondary operation is recovered. All safeties including refrigerant pressures and freeze protection are preserved. The primary module includes a 7-inch touch screen interface panel with graphical display and allows for general operation, setpoint adjustments, and alarm monitoring of the following parameters:
    a. Adjustable fluid temperature setpoint
    b. Multiple stage compressor control, including compressor rotation to provide even compressor usage and wear
    c. High and low fluid temperature alarm setpoints
    d. Fluid inlet and outlet temperature
    e. Suction and discharge refrigeration pressure
    f. Compressor run status
    g. Current alarm status
    h. Alarm logging (Up to 2000 alarms with time and date of each occurrence
    i. Demand load
    j. Compressor run hours
    k. Remote start stop input
    l. Dry contact for general alarm
15. Variable Flow: These units have been designed and/or selected for variable flow operation. There are several system considerations that should be evaluated to ensure reliable operation. Please refer to Application Guide - Modular Chillers in Variable Primary Flow Chilled Water Systems (PKG-APG001C-EN) for additional information.
16. Electrical Options:
    a. Consolidated Power Distribution: A single electrical power supply feeds a power distribution panel. Two power connections are required when MOP > 1000A. The panel is mounted on the primary module as standard (or lead-free cooling module or tank and pump module, if equipped) and contains a circuit breaker for each module for branch circuit overload protection for both high and standard fault systems. Terminal block is standard unless disconnect selected.
17. Other Options
    a. Copper Finned Condenser Coil: For corrosive or harsh coastal environments, condenser coils can be offered with all copper fin construction instead of aluminum. Copper has better corrosion resistance than aluminum. The copper tubes are mechanically

expanded into the fin collars providing a permanent metal-to-metal bond for efficient heat transfer.

b. ASME UM Stamp: ASME Boiler and Pressure Vessel Code is stamped on the heat exchanger(s)to certify that the equipment conforms to the rules governing the design, fabrication, assembly, and inspection of boiler and pressure vessel components during construction.

18. Factory-Supplied, Field-Installed Accessories
    a. Temperature Header Accessory: 6 inch long, grooved pipe with temperature well. Pre-wired system temperature sensor on primary controller must be field installed in well.
    b. Victaulic Couplings: Victaulic couplings are provided for module-to-module hydronic connections when multiple modules are selected.

C. Pumps:
1. General: Refer to Paragraph 2.6A for general requirements. Pumps shall be selected to be non-overloading at any point on the pump curve. Contractor shall include all costs required to field trim or change pump impeller, if necessary, to match design conditions. All motors 1 horsepower and larger shall be the high efficiency type. Bell and Gossett, Grundfos, PACO, Peerless, Taco.
2. Materials and Components: Enclosed bronze impeller hydraulically and dynamically balanced on shaft. Renewable bronze wear rings. Mechanical seals unless otherwise noted. Stainless steel shaft or steel shaft with bronze sleeve. Gray iron casing. Suction and discharge connections shall be 125 psi flanges tapped for pressure readings.
3. End Suction Centrifugal: - Pedestal Mounted: Single stage, single suction centrifugal pump mounted on steel pedestal base. Regreaseable double ball bearing. Pump direct connected to motor through a Woods metal/rubber coupling. Cal OSHA coupling guard. Bearing frame and rotating parts shall be removable without disturbing volute casing or piping. Impeller keyed and locked to shaft. Air vent and drain. Pump and motor mounted on reinforced steel base with raised lips, drain taping, and grouting hole. Pump volute shall be supported by the base. Pump and motor shall be realigned according to Hydraulic Institute Standards after grouting of base and connection of piping. Provide factory start up.

D. Rooftop Package Heat Pump:
1. General: Self-contained heat pump designed for outdoor installation. Factory assembled and tested. Refer to Paragraph 2.6A for general requirements. Provide all starters and relays required for operation. 24-volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Indoor air section fully insulated. Outside air inlet. Drain pan. Multivane centrifugal supply fan. ARI certified. Trane.
2. Refrigeration: Sealed hermetic compressor with internal vibration isolating mount. Crankcase heater, high/low pressure switch, recycling timer. Suction line accumulator. Air cooled condenser with propeller fan. Nonferrous finned coil. Low ambient control to 35 degrees. 5-year extended warranty on compressor(s).
3. Controls: Compressor and fan motors shall have both thermal and current sensitive overload devices. Automatic defrost control (only if required) every 90 minutes for a period of not more than 10 minutes.
4. Accessories: Electric resistance heater, nichrome elements, over temperature and overcurrent protection. Emergency heat control to allow heater operation if compressor is inoperative.

E. Air Handler:
1. General: Pressure classification, type, and accessories/options as indicated on schedules. Vertical or horizontal orientation as scheduled. Refer to Paragraph 2.6A for general requirements. Manufacturer to provide an integral base frame for either ceiling suspension of units or to support and raise all sections of the unit for proper trapping. Contractor will be responsible for providing a housekeeping pad when unit base frame is not of sufficient height to properly trap unit. Unit base frames not constructed of galvanized steel shall be chemically cleaned and coated

with both a rust-inhibiting primer and finished coat of rust-inhibiting enamel. Unit base height to be included in trap. Trane.

2. Unit Casing: Unit manufacturer shall ship unit in segments as specified by the contractor for ease of installation in tight spaces. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTM B117 250-hour salt-spray test. The removal of access panels or access doors shall not affect the structural integrity of the unit. All removable panels shall be gasketed. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit. Casing performance - Casing air leakage shall not exceed leak class 6 (CL = 6) per ASHRAE 111 at specified casing pressure, where maximum casing leakage (cfm/100 ft2 of casing surface area) = CL X P0.65. Air leakage shall be determined at 1.25 times maximum casing static pressure up to 8 inches w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE 111 Leakage Class. Under 55F supply air temperature and design conditions on the exterior of the unit of 81F dry bulb and 73F wet bulb, condensation shall not form on the casing exterior. The AHU manufacturer shall provide tested casing thermal performance for the scheduled supply air temperature plotted on a psychrometric chart. The design condition on the exterior of the unit shall also be plotted on the chart. If tested casing thermal data is not available, AHU manufacturer shall provide, in writing to the Engineer and Owner, a guarantee against condensation forming on the unit exterior at the stated design conditions above. The guarantee shall note that the AHU manufacturer will cover all expenses associated with modifying units in the field should external condensate form on them. In lieu of AHU manufacturer providing a written guarantee, the installing contractor must provide additional external insulation on AHU to prevent condensation. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8-inch w.g., whichever is less, and shall not exceed 0.0042 per inch of panel span (L/240). Unit casing panels shall be 2-inch double-wall construction, with solid galvanized exterior and solid galvanized interior, to facilitate cleaning of unit interior. Unit casing panels (roof, walls, floor) and doors shall be provided with a minimum thermal resistance (R-value) of 13 Hr*Ft2*°F/BTU. Unit casing panels (roof, walls, floor) and external structural frame members shall be completely insulated filling the entire panel cavity in all directions so that no voids exist. Panel insulation shall comply with NFPA 90A. Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels. Access panels and/or access doors shall be provided in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance.
3. Access Doors: Access doors shall be 2-inch double-wall construction. Interior and exterior shall be of the same construction as the interior and exterior wall panels. All doors downstream of the cooling coil shall be provided with a thermal break construction of door panel and door frame. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage. Door hardware shall be surface-mounted to prevent through-cabinet penetrations that could likely weaken the casing leakage and thermal performance. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions. All doors shall be a 60-inch high when sufficient unit height is available, or the maximum height allowed by the unit height. Multiple door handles shall be provided for each latching point of the door necessary to maintain the specified air leakage integrity of the unit.
4. Primary Drain Pans: All cooling coil sections shall be provided with an insulated, double-wall, stainless steel drain pan. The drain pan shall be designed in accordance with ASHRAE 62.1 being of sufficient size to collect all condensation produced from the coil and sloped in two planes, pitched toward drain connections, promoting positive drainage to eliminate stagnant water conditions when unit is installed level and trapped per manufacturer's requirements. See section 2.07, paragraph F through H for specifications on intermediate drain pans between cooling coils. The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to

preclude drain pan overflow under any normally expected operating condition. Drain connections shall be of the same material as the primary drain pan and shall extend a minimum 2-1/2-inch beyond the base to ensure adequate room for field piping of condensate traps. The installing contractor is responsible to ensure the unit is installed level, trapped in accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate. Coil support members inside the drain pan shall be of the same material as the drain pan and coil casing. If drain pans are required for heating coils, access sections, or mixing sections they will be indicated in the plans.

5. Fans: Fan sections shall have a minimum of one hinged and latched access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components. Construct door(s) per Section 2.04. Provide fans of type and class as specified on the schedule. Fan shafts shall be solid steel, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM to meet design specifications. Fans that are selected with inverter balancing shall first be dynamically balanced at design RPM. The fans then will be checked in the factory from 25% to 100% of design RPM to insure they are operating within vibration tolerance specifications, and that there are no resonant frequency issues throughout this operating range. Inverter balancing that requires lockout frequencies inputted into a variable frequency drive to in order to bypass resonant frequencies shall not be acceptable. If supplied in this manner by the unit manufacturer, the contractor will be responsible for rebalancing in the field after unit installation. Fans selected with inverter balancing shall have a maintenance free, circumferential conductive micro fiber shaft grounding ring installed on the fan motor to discharge shaft currents to ground. Belt-driven fans shall be provided with grease lubricated, self-aligning, anti-friction bearings selected for L-50 200,000-hour average life per ANSI/AFBMA Standard 9. Lubrication lines for both bearings shall be extended to the drive side of the AHU and rigidly attached to support bracket with zerk fittings. Lubrication lines shall be a clear, high-pressure, polymer to aid in visual inspection. If extended lubrication lines are not provided, manufacturer shall provide permanently lubricated bearing with engineering calculations for proof of bearing life. All fans, including direct drive plenum fans, shall be mounted on isolation bases. Internally-mounted motor shall be on the same isolation base. Fan and motor shall be internally isolated with spring isolators. Unit sizes up to a nominal 4,000 CFM shall have 1-inch spring isolation. Units with nominal CFM's higher than 4,000 shall have 2-inch springs. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor in order to avoid transmission of noise and vibration through the ductwork and building structure.

6. Motors and Drives: All motors and drives shall be factory-installed and run tested. All motors shall be installed on a slide base to permit adjustment of belt tension. Slide base shall be designed to accept all motor sizes offered by the air-handler manufacturer for that fan size to allow a motor change in the future, should airflow requirements change. Fan sections without factory-installed motors shall have motors field installed by the contractor. The contractor shall be responsible for all costs associated with installation of motor and drive, alignment of sheaves and belts, run testing of the motor, and balancing of the assembly. Motors shall meet or exceed all NEMA Standards Publication MG 1 - 2006 requirements and comply with NEMA Premium efficiency levels when applicable. Motors shall comply with applicable requirements of NEC and shall be UL Listed. Fan Motors shall be heavy duty, open drip-proof operable at 460 volts, 60Hz, 3-phase. If applicable, motor efficiency shall meet or exceed NEMA Premium efficiencies. Belt driven fans shall use 4-pole, 1800 rpm, motors, NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F (40 deg C) without tripping overloads. V-Belt Drive shall be fixed pitch rated at 1.5 times the motor nameplate. Drives 20 hp and larger or any drives on units equipped with VFDs shall be fixed pitch. Manufacturer shall provide for each fan a nameplate

with the following information to assist air balance contractor in start up and service personnel in maintenance:

a. Fan and motor sheave part number
b. Fan and motor bushing part number
c. Number of belts and belt part numbers
d. Fan design RPM and motor HP
e. Belt tension and deflection
f. Center distance between shafts.

7. Coils: See paragraph 2.6, A, 12 for coils. Coils section header end panel shall be removable to allow for removal and replacement of coils without impacting the structural integrity of the unit. Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint. Construct coil casings of galvanized steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover. When two or more cooling coils are stacked in the unit, an intermediate drain pan shall be installed between each coil. The intermediate drain pan shall be designed being of sufficient size to collect all condensation produced from the coil and sloped to promote positive drainage to eliminate stagnant water conditions. The intermediate drain pan shall be constructed of the same material as the sections primary drain pan. The intermediate drain pan shall begin at the leading face of the water-producing device and be of sufficient length extending downstream to prevent condensate from passing through the air stream of the lower coil. Intermediate drain pan shall include downspouts to direct condensate to the primary drain pan. The intermediate drain pan outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.
8. Filters: Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter section shall have side access filter guides and access door(s) extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.04. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter replacement. Filters to be of size, and quantity needed to maximize filter face area of each particular unit size. Filter type, MERV rating, and arrangement shall be provided as defined in project plans and schedule. Manufacturer shall provide one set of startup filters.
9. Dampers: All dampers, with the exception of external bypass and multizones (if scheduled), shall be internally mounted. Dampers shall be premium ultra low leak and located as indicated on the schedule and plans. Blade arrangement (parallel or opposed) shall be provided as indicated on the schedule and drawings. Dampers shall be Ruskin CD60 double-skin airfoil design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 4 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage and shall be AMCA licensed for Class 1A. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Manufacturer shall submit brand and model of damper(s) being furnished, if not Ruskin CD60.
10. Factory VFD. Refer to schedule on drawings for type.
11. Start-up: Provide equipment startup by factory or factory trained technicians.

F. Makeup Air Unit:

1. General: Pressure classification, type, and accessories/options as indicated on schedules. Refer to Paragraph 2.6A for general requirements. All units will be shipped with an integral base frame designed with the necessary number of lift points for safe installation. The lift points will be designed to accept standard rigging devices and be removable after installation. Units shipped in sections will have a minimum of four points of lift. Sizes 3-30 will also be shipped with a shipping skid designed for forklift transport. Units will be shipped with a shipping skid designed for forklift transport and the integral base will be designed with the necessary number of lift points for safe installation. The lift points will be designed to accept standard rigging devices and removable after installation. Units shipped in sections will have a minimum of four points of lift. Per ASHRAE 62.1 recommendation, units will be shipped stretch-wrapped to protect unit from in transit rain and debris. Unit shall be UL and C-UL Listed. Air-handling performance data shall be certified in accordance with AHRI Standard 430. Unit sound performance data shall be provided using AHRI Standard 260 test methods and reported as sound power. Coil performance shall be certified in accordance with AHRI Standard 410. Trane.
2. Unit Construction: All unit panels shall be 2-inch solid, double-wall construction to facilitate cleaning of unit interior. Unit panels shall be provided with a mid-span, no through metal, internal thermal break. Casing thermal performance shall be such that under 55°F supply air temperature and design conditions on the exterior of the unit of 81°F dry bulb and 73°F wet bulb, condensation shall not form on the casing exterior. All exterior and interior AHU panels will be made of G40 galvanized steel. Optionally, all interior AHU casing panels will be made of 201 stainless steel. The casing shall be able to withstand up to 8 inches w.g. positive or negative static pressure. The casing shall not exceed 0.0042 inch deflection per inch of panel span at 1.5 times design static pressure up to a maximum of +8 inches w.g. in all positive pressure sections and -8 inches w.g. in all negative pressure sections. The unit floor shall be of sufficient strength to support a 300-lb. load during maintenance activities and shall deflect no more than 0.0042 inch per inch of panel span. The casing air leakage shall not exceed leak class 9 (CL = 9) per ASHRAE 111 at 1.25 times maximum casing static pressure (P in inches w.g.), up to a maximum of +8 inches w.g. in all positive pressure sections and -8 inches w.g. in all negative pressure sections, where maximum casing leakage (cfm/100 ft2 of casing surface area) = CL x P0.65. Optionally, the casing air leakage shall not exceed leak class 6 (CL = 6) per ASHRAE 111 at 1.25 times maximum casing static pressure (P in inches w.g.), up to a maximum of +8 inches w.g. in all positive pressure sections and -8 inches w.g. in all negative pressure sections, where maximum casing leakage (cfm/100 ft2 of casing surface area) = CL x P0.65.
3. Insulation: Panel insulation shall provide a minimum thermal resistance (R) value of 13 ft²•h•ºF/Btu throughout the entire unit. Insulation shall completely fill the panel cavities in all directions so that no voids exist and settling of insulation is prevented. Panel insulation shall comply with NFPA 90A.
4. Drain Pans: All cooling coil sections shall be provided with an insulated, double-wall, galvanized or stainless-steel drain pan. To address indoor air quality (IAQ), the drain pan shall be designed in accordance with ASHRAE 62.1 being of sufficient size to collect all condensation produced from the coil and sloped in two planes promoting positive drainage to eliminate stagnant water conditions. The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition. All drain pan threaded connections shall be visible external to the unit. Drain connections shall be of the same material as the primary drain pan and shall extend a minimum of 2 1/2 inches beyond the base to ensure adequate room for field piping of condensate drain traps. Coil support members inside the drain pan shall be of the same material as the drain pan and coil casing. Heating coil, access, and mixing sections may be provided with an optional IAQ drain pan.
5. Access Doors: Access doors shall be 2-inch double-wall construction. Interior and exterior door panels shall be of the same construction as the interior and exterior wall panels, respectively. All doors downstream of cooling coils shall be provided with a thermal break construction of door panel and door frame. Gasketing shall be provided around the full perimeter of the doors to prevent air leakage. Surface-mounted handles shall be provided to allow quick access to the interior of the functional section and to prevent through-cabinet penetrations that could likely

weaken the casing leakage and thermal performance. Handle hardware shall be designed to prevent unintended closure. Access doors shall be hinged and removable for quick, easy access. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section. All doors shall be a minimum of 60 inches high when sufficient height is available, or the maximum height allowed by the unit height. Door handles will be provided for each latching point of the door necessary to maintain the specified air leakage integrity of the unit. Optionally, a single-handle door shall be provided for all outward swinging doors linked to multiple latching points necessary to maintain the specified air leakage integrity of the unit. An optional shatterproof window for viewing, capable of withstanding unit operating pressures, shall be provided in the door.

6. Marine Lights: A factory-mounted, weather-resistant (enclosed and gasketed to prevent water and dust intrusion), light emitting diode (LED) fixture shall be provided in sections of the unit as specified for maintenance and service visibility. Fixture shall be complete with aluminum die cast housing, polycarbonate lens designed for maximum light output, and LEDs wired to a single switch within a factory-provided service module. LED lighting shall provide instant-on white light and have a minimum 50,000 hour life. Fixtures shall be designed for flexible positioning during maintenance and service activities for optimal location. All lights within the unit shall be wired to a single switch within the factory provided service module. The service module shall have an optional GFCI receptacle separate from the load side of the equipment. Electrical contractor shall be required to provide a 120V supply to the factory mounted service module for the marine light circuit (unless single-point power is provided) and always for the GFCI receptacle circuit per NEC. The service module shall be provided in the fan section, unless a controls section is provided. In which case, the service module will be provided in the controls section. The light switch is always on the supply fan.
7. Fans: The fan type shall be provided as required for stable operation and optimum energy efficiency. The fan shall be statically and dynamically balanced at the factory as a complete fan assembly (fan wheel, motor, drive, and belts). The fan shaft shall not exceed 75 percent of its first critical speed at any cataloged speed. Fan wheels shall be keyed to the fan shaft to prevent slipping. The fan shafts shall be solid steel. The fan section shall be provided with an access door on the drive side of the fan. The fan shall be a single-width, single-inlet plenum fan. The fan blades shall be aluminum backward-inclined airfoil. Plenum fan shall be direct-driven. Fan sections containing multiple fans shall be controlled using a common control signal, such as the duct static control signal, to modulate the fan speed. The fan and motor assembly (on sizes 10 to 120) shall be internally isolated from the unit casing with 2-inch (50.8-mm) deflection spring isolators, furnished and installed by the unit manufacturer. The isolation system shall be designed to resist loads produced by external forces, such as earthquakes, and conform to the current IBC seismic requirements. The motor shall be integrally mounted to an isolated fan assembly furnished by the unit manufacturer. The motor shall be mounted inside the unit casing on an adjustable base to permit adjustment of drive-belt tension. The motor shall meet or exceed all NEMA Standards Publication MG1 requirements and comply with NEMA Premium efficiency levels when applicable. The motor shall have T-frame, squirrel cage with size, type, and electrical characteristics as shown on the equipment schedule. The motor shall be open and drip-proof, 460 volt, 3-phase, 60 Hz. The fan section shall have motor leads extended to a factory-installed external junction box to facilitate motor wiring and to maintain air leakage integrity of the casing. The fan motor wiring shall be factory-wired to the external motor junction box within flexible metal conduit of adequate length so that the fan vibration isolation will not be restricted. On units supplied with plenum fans, expanded metal door guard(s) shall be supplied on the access door(s) to the fan, and those downstream access door(s) where unintended access to the plenum fan could occur. Door guard in intended to deter unauthorized entry and incidental contact with rotating components. Refer to the Product Data section for fans with access door guard(s).
8. Coils: Refer to paragraph 2.6, A, 12.

9. Filters: Filter sections shall have filter racks, at least one access door for filter removal, and filter blockoffs to prevent air bypass around filters. The filter sections shall be supplied with 2-inch filters. The filters shall be 2-inch, made with 100 percent synthetic fibers that are continuously laminated to a supported steel-wire grid with water repellent adhesive. Filters shall be capable of operating up to 625-fpm face velocity without loss of filter efficiency and holding capacity. The filters shall have a MERV 13 rating when tested in accordance with the ANSI/ASHRAE Standard 52.2.
10. Mixing Section: A functional section shall be provided to support the damper assembly for outdoor, return, and/ or exhaust air. Dampers shall modulate the volume of outdoor, return, or exhaust air. The dampers shall be of double-skin airfoil design with metal, compressible jamb seals and extruded-vinyl blade-edge seals on all blades. The blades shall rotate on stainless-steel sleeve bearings. Airfoil dampers shall be rated for a maximum leakage rate of 3 cfm/ft² at 1 in. w.g. complying with ASHRAE 90.1 maximum damper leakage. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Dampers may be arranged in a parallel or opposed-blade configuration.
11. Outdoor Unit Paint: External surface of unit casing shall be prepared and coated with a minimum 1.5 mil enamel finish or equal. Units supplied with casing exterior factory-painted shall be able to withstand a salt spray test in accordance with ASTM B117 for a minimum of 500 consecutive hours. Unit casing exterior will be provided with manufacturer's standard color, or alternative color when required.
12. Outdoor Unit Roof: Trane engineered inner roofs incorporate mid-span, internal thermal breaks to eliminate thermal conduction paths from the interior of the air handler to the exterior (2-inch R13 foam-insulated). Inner/ Indoor/ roof will be installed in such a manner as to prevent air bypass between internal components. A single layer Outer/Outdoor roof is utilized above the inner roof and will be sloped at a minimum 0.125 inches per foot either from one side of unit to other, or from center to sides of the unit. Roof assembly will overhang all walls of units by a 1.5-inch minimum.
13. Access/Inspection Sections: A section shall be provided to allow additional access/inspection of unit components and space for field-installed components as needed. The section length shall be variable to accommodate specific access, spacing, or dimensional requirements. An access door shall be provided for easy access. All access sections shall be complete with a double-wall, removable door downstream for inspection, cleaning, and maintenance. Interior and exterior door panels shall be of the same construction as the interior and exterior wall panels, respectively. All doors downstream of cooling coils shall be provided with a thermal break construction of door panel and door frame.
14. Controls: A Variable Frequency Drive (VFD) shall be provided when variable air volume control is required for fan operation. Whether for single fan, or dual fan applications, a single VFD shall be provide to ensure proper operation and to optimize operating life. Each VFD shall be properly sized, factory mounted, wired to the fan motor, and commissioned to facilitate temporary heating, cooling, ventilation, and/or timely completion of the project. The VFD package shall also include:
    a. Electronic manual speed control
    b. Inlet fuses to provide maximum protection against inlet short circuit
    c. Current limited stall prevention
    d. Auto restart after momentary power loss
    e. Speed search for starting into rotating motor
    f. Anti-windmill w/DC injection before start
    g. Phase-to-phase short circuit protection
    h. Ground fault protection

    Units with factory-mounted controls shall include power wiring from the VFD panel to the control system, binary output on/off wiring, analog output-speed-signal wiring, binary fault signal wiring and all interfacing wiring between the VFD and the direct control interface. The VFD shall be covered by UL1995/60335 Standards.
15. Start-up: Provide equipment startup by factory or factory trained technicians.

G. Exhaust Fan:

1. General: All exhaust fans shall be tested and rated in accordance with AMCA Standard 210. Fans exposed to weather shall have ventilated weatherproof housing over motor and drive assembly. Refer to Paragraph 2.6A for general requirements. All direct drive fans shall be provided with unit mounted speed controllers. All exhaust fans shall have a disconnect switch. All motors 1 horsepower and larger shall be the premium efficiency type.
2. Ceiling Fan (Direct): 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. Roof Fan (Direct, Downblast): Spun aluminum, roof mounted, direct driven, downblast centrifugal exhaust ventilator. Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners and stainless-steel fasteners on cap. Spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. Aluminum base shall have continuously welded curb cap corners for maximum leak protection. Discharge baffle shall have a rolled bead for added strength. An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections. Motor shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. An aerodynamic aluminum inlet cone shall be provided for maximum performance and efficiency. Motor shall be heavy duty type with permanently lubricated sealed bearings and furnished at the specified voltage, phase and enclosure. Backdraft damper. Greenheck.
3. Kitchen Exhaust Fan (Direct, Upblast): Spun aluminum, roof mounted, direct driven, upblast centrifugal exhaust ventilator. Fan shall be UL 705 – Supplement SC listed. Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners and stainless steel fasteners on cap. Spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. Aluminum base shall have a one piece inlet spinning and continuously welded curb cap corners for maximum leak protection. Windband shall have a rolled bead for added strength. A two piece top cap shall have stainless steel quick release latches to provide access into the motor compartment without the use of tools. An integral conduit chase shall be provided into the motor compartment to facilitate wiring connections. The motor shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate. Wheel shall be centrifugal backward inclined, constructed of 100 percent aluminum, including a precision machined cast aluminum hub. An aerodynamic aluminum inlet cone shall be provided for maximum performance and efficiency. Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure. Exhaust fan shall have roof curb and hinged base with lock hasp and galvanized aircraft cable supports. Metal grease trough. Weep hole. Greenheck.
4. Relief 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.

H. Split System Heat Pump (IDU/ODU):
1. General: Refer to Paragraph 2.6A for General Requirements. Completely assembled and factory tested. Provide all starters and relays required for operation. All components by same manufacturer. Mitsubishi.
2. Outdoor Unit:
   a. Compressor: Sealed hermetic rotary compressor with vibration isolator mountings. Crankcase heater, suction line accumulator, recycling timer. High and low head pressure/temperature protection. Motor overload protection, low ambient feature to 20F cooling mode. High and low side service valves. Recycling timer. Single phase start assist kit. 5-year extended warranty.
   b. Fan and Coil: Finned tube non-ferrous coil. Propeller type fan, 1200 RPM maximum, direct drive. Totally enclosed motor, overload protected, permanently lubricated, resiliently mounted.
   c. Cabinet: Weatherproof, factory paint.
3. Indoor Unit:
   a. Supply Fan: Direct drive, multi-speed forward curve, centrifugal fan, resiliently mounted. Thermally protected motor.
   b. Indoor Coil: Copper tube, aluminum fin, DX coil.
   c. Electric Heaters: Integral part of unit, complete with all operational and safety controls, single point wiring terminal, 5-year factory warranty, UL listed as a complete unit.
   d. Condensate Pan: Install under complete coil area with drain connections.
   e. Filter: Washable media. Class 2 or better.
4. Controls: Microprocessor control containing temperature selection, room temperature indication, automatic cooling/heating changeover, malfunction alarm, power failure automatic restart safety, and emergency operation function.

I. Fly Fan: See Equipment Schedule on Mechanical Drawings.

J. Radiant Heater: See Equipment Schedule on Mechanical Drawings.

K. Evaporator Unit (E):
1. General: Indoor unit designed for refrigerator or freezer use, as applicable. Refer to paragraph 2.6A for General Requirements. Russell.
2. Housing: Rust-free, heavy gauge, textured Aluminum casing. Each fan section shall be baffled to prevent short cycling of the air. The unit shall be designed to mount flush to the ceiling and shall meet all NSF requirements. Slotted hangers shall be provided for easy installation. Drain fittings shall be installed in the horizontal position. End panels shall be hinged to open up out. Expansion valves installed inside the cabinet.
3. Coil: Seamless copper tubes, staggered and mechanically expanded into corrugated aluminum fins and heavy gauge tube sheets. Die formed fin collars. Fin spacing shall be 8 fins per inch maximum. Sweat connections.
4. Motors: All motors shall be 1/20 HP, permanently lubricated, ball bearing, with thermal overload protection. Available in 115V, 208/230V and optional 460V, single Phase.
5. Fans: Heavy duty 12” aluminum fans, balanced to provide vibration-free operation. Low throw black plastic fan guards.
6. Electrical: All components shall be factory wired to convenient screw-type terminal strips. All electrical components shall be mounted in an internal compartment, accessible by removing the end panel. UL listed.

7. Electric Defrost: Place heaters internal to the coil to allow for an extremely rapid and efficient defrost. This arrangement enables the heat to be conducted through the fins from the center out for an even defrost pattern. All heaters shall be wired to a terminal strip to allow a quick field change-over from single phase to three phase, 230V to 460V and vice versa. A lower heater shall be installed close to the drain pan for fast, reliable drainage. A defrost termination thermostat (DT) shall terminate the defrost cycle when the temperature is satisfied. A heater safety thermostat shall be installed to prevent heaters from overheating above 75ºF in case of DT failure. All heaters shall be flexible and shall be easily replaced within 12 inches of the end of the units. A fan delay thermostat shall be supplied to allow the warm coil to cool after a defrost cycle prior to the fans turning on. Components shall include Timer, Auxiliary Switch Block-Out Relay, Defrost Contactor, Fan Contactor, Sequencing Relays.

L. Condensing Unit (CU): Refer to paragraph 2.6A for General Requirements. Low profile condensing unit designed for outdoor installation. Refrigerant shall be R-448A as scheduled. Compressor(s) shall be hermetic. Copper tubes/Aluminum fins. Large electrical control panel for power and control circuits. Compressor contactor or start kit. Encapsulated high and low pressure controls (adjustable low pressure control on low temp models). Refrigerant receiver with shutoff valve and relief plug. Liquid line kit with filter/drier and sight glass with moisture indicator. Suction line piping to exterior of cabinet. Low Ambient - flooded head pressure control valve. Crankcase heater. Factory installed electric defrost timer with defrost contactor/relay on low temperature models. Low ambient flooded control. Wire fan guard(s) kit. Suction accumulator. Liquid line solenoid. Fused disconnect. Spring mounting for semi-hermetic compressors. All-weather housing. UL listed for indoor or outdoor use. Designed for operation in ambient air temperatures up to 110°F. Russell.

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. Lines shall be adequately braced against vertical and lateral movement. 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. Welded or Brazed: Filler rod shall be of suitable or the same alloy as pipe. Brazing filler metal shall have a minimum melting point of 1100ºF. Welding or brazing shall be performed by a Certified Welder or 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. At equipment connections, valves shall be full size of upstream piping. Provide a shut-off valve at each point of connection to existing piping.
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 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. 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.

Pipe Size (In.)	Maximum Spacing Between Supports (Ft.)*		
	Copper	Sch. 40 Steel	Plastic
1/2	6	6	4
3/4	6	8	4
1	6	8	4
1-1/4	6	8	4
1-1/2	6	10	4
2	10	10	4
2-1/2	10	10	4
3	10	10	4
4	10	10	4
6	10	10	4
8	10	10	4

*Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves or other fittings. Plastic piping shall be supported per the manufacturer's recommendations. Seismic requirements may reduce maximum spacing.
b. Hot Water Piping: Support individual pipes with insulation support and pipe hanger. Install per manufacturer's recommendations.
c. Chilled Water Piping: Support individual pipes with insulation support and pipe hanger. Install per manufacturer's recommendations. Piping shall have complete vapor seal.
d. 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.
e. Trapeze: Trapeze hangers of channel and pipe clamps may be used. Submit design to Engineer for review.

5. Miscellaneous:

a. Escutcheons: Provide chrome plated escutcheons where piping penetrates walls, ceilings, or floors in finished areas.
b. Pipe Sleeves: All piping passing through concrete or concrete block shall be provided with pipe sleeves. Allow 1" (nominal) clearance between sleeve and pipe or pipe insulation. 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 or Pressure 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. Hot or Chilled Water Piping: Provide shut-off valve for each building and at each connection to equipment. Before threading, welding or grooving any pipe, it shall have a cloth material of the proper size pulled through pipe to clean out any foreign material, and then a visual inspection through pipe to verify it is clean. Any process done to pipe end will require that pipe end be inspected inside before a fitting is fitted to pipe (to insure that cutting oil or pipe burrs are removed). Always have pipe threading machine sloped to prevent cutting oil from running into the pipe. Branch lines leaving horizontal lines shall leave on the horizontal or at an upslope of 45°, unless they are rising up to another horizontal line which will insure the pipe to remain air free. All high points in any part of the system shall have the means to purge air. Unless otherwise noted all vents shall be 1/4" petcocks with 1/4" copper tube discharge. Route tube to condensate pan, floor sink, etc. If a drain point is not available, terminate tube with a return bend to allow water to be collected. Before connection to equipment, all piping shall be thoroughly flushed with water. Only equipment mounted on vibration isolators shall be connected with flexible connection. The manufacturer of the underground piping system shall instruct the installer regarding the manufacturer's required installation procedures. The manufacturer shall also provide sufficient job-site inspection to insure that the work is being accomplished in accordance with the plans, specifications and manufacturer's requirements. Upon completion of the installation, a certificate shall be furnished to the Architect by the manufacturer of the system, certifying the installation was made in accordance with his requirements and in compliance with the plans and specifications.

C. Refrigerant Piping: Pipe shall be cut square. Joint surfaces shall be thoroughly cleaned, fitted and erected before brazing. Continuously purge with Nitrogen during brazing. After installation, evacuate to 29 inches of mercury, ambient temperature during evacuation shall not be less than 70ºF. 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. Chilled and Hot Water Supply and Return:
1. General: All chilled and hot water supply and return piping (including all fittings and accessories) and all chilled water equipment shall be insulated. Insulate a sufficient length of make-up water piping to prevent condensation.
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, solvent welded. Seal all joints with

factory supplied pressure sealing vapor barrier tape with a 1-1/2" (min.) overlap on both sides of joint. Insulate all flanges, unions and valves except stems and operators. All joints on chilled water piping shall be sealed with vapor barrier coating in addition to the vapor barrier tape.

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 reinforcing mesh, one coat of lagging adhesive, and a final coat of vapor barrier coating.

4. Vapor Barrier Continuity: All exposed ends of insulation and all gaps or voids in vapor barrier shall be sealed with reinforcing mesh, one coat of lagging adhesive and a final coat of vapor barrier coating. Build up all horizontal areas to prevent water accumulation.
5. Pipe Hangers: Seal all joints at pipe hangers with vapor barrier tape. Joints on chilled water piping shall be sealed with vapor barrier coating in addition to the vapor barrier tape.
6. Piping Exposed to Weather:
   a. All piping and fittings exposed to weather shall have, in addition to the above described insulation, an aluminum jacketing. Insulation at grooved pipe couplings shall be covered with aluminum flange fitting covers. Secure in place with factory supplied straps. Install all joints and seams to prevent water entry, seal with 1/8” bead of gray metal jacketing sealant.
   b. For miscellaneous fittings for which aluminum jackets are not available or where proximity of fittings precludes a neat-appearing installation, the Contractor may cover the insulation with reinforcing mesh and at least two coats of outdoor mastic. Plastic fitting covers shall not be used where exposed to weather.
7. 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. Do not install this jacket where it will be subjected to a temperature of 150ºF or more such as immediately adjacent to boilers. In these locations install reinforcing mesh, one coat of lagging adhesive and a final coat of vapor barrier coating.
8. Equipment: Chilled water equipment with continuous circulation (pumps, heat exchanger, etc.), shall be insulated with materials similar to those described in Paragraph 2-02. It shall be the Contractor's responsibility to provide adequate insulation to prevent condensation, a complete vapor barrier, weatherproofing for equipment exposed to the weather, and a neat-appearing installation. Insulate hot water equipment same as above except no vapor barrier. Submit materials and method of installation to Engineer for review.

B. 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. Remote regulator shall be as detailed on drawings.
3. Flanges and Escutcheon: Where ductwork penetrates walls, ceilings, or floors, furnish and install flange or escutcheon of same material as duct.

4. 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.

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 outdoor sealant. (See Part 2 of this Specification). All joints on metal ductwork exposed to view inside building shall be sealed air tight with grey duct sealant.
   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 shall be in accordance with SMACNA Standards (turn radius of duct centerline not less than 1.5 times the duct diameter).
3. Spiral Wound Metal Ductwork: At side duct grilles, the grille shall be cut directly into the spiral duct. Duct to duct joints shall be made with the spiral seam rotated so that the seam forms a continuous helical pattern across the joint.
4. Moisture Bearing Exhaust Ductwork: Joints shall be made with male end in direction of airflow and shall be sealed watertight with mastic. Unless otherwise indicated, the ducts shall slope down towards the source of moisture (grille, hood, drier, etc.). Sheet metal screws or any other device that protrudes into the duct shall not be used for clothes drier exhaust ducts.
5. Grease Bearing Exhaust Ductwork: Horizontal portions of the duct shall slope down towards the hood at 1/4" per foot (min.) unless the total horizontal length exceeds 75 feet, then the slope shall be 1" per foot (min.). Provide access panels at changes of direction as required by CMC. Drains shall be provided at low points in horizontal ducts per 2022 CMC 510.1.3. Horizontal ducts shall be provided with access in accordance with 2022 CMC Section 510.3.3.

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.

B. Fire/Smoke Damper: Shall be installed in accordance with the manufacturer's recommendations. Provide access doors as required, label per CBC. Manufacturer's instructions shall be available to the inspecting authorities. Shall be tested according to State Fire Marshal requirements.

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.

E. Fire Resistive Wrapped Ducts: Where indicated on drawings, ductwork shall be covered with fire resistive duct wrap. Install in accordance with it’s UL or Omega Point Laboratories Design number (as applicable) and the Manufacturer’s Installation Instructions.

3.6 EQUIPMENT INSTALLATION:

A. General: It shall be the responsibility of the equipment installer to ensure 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. All equipment shall be installed level.

B. Air Handling Units: Spring isolators shall be adjusted to allow movement to maximum free spring length. Piping support shall be designed so that piping weight does not bear on equipment. Hot water coil shall be mounted upstream of chilled water coil.

C. Gage Taps: Gage taps, such as Pete's Plugs, shall be installed immediately adjacent to all heat exchanger and pump connections (i.e. inlet and outlet of all pumps, boilers, chillers, condensers, coils, etc.). Taps shall be installed to allow for a pressure gage or thermometer to be easily inserted and read. Provide 1 set of gages (pressure gage with Pete's Plug adapter, chilled water thermometer and hot water thermometer). Deliver to Owner.

D. 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.

E. Pumps: Install pumps with a minimum of 8 diameters of straight pipe at the pump suction unless a suction diffuser is installed. Sufficient clearance to wall or other obstructions shall be provided so that motor and rotating parts can be removed without disassembly of volute or piping. Anchor bolt configuration shall be compatible with this method of removal. Pedestal mounted pumps shall have their bases grouted. Realign pump and motor according to Hydraulic Institute Standards after grouting and connection of piping.

F. Equipment Platforms: Shall be as shown on drawings and as follows: Flashing and platform cover shall be 22 gage (min.) sheet metal. All joints and seams shall be soldered with 2" (min.) overlaps. Provide 3/4" gap around perimeter between roofing and platform cover to facilitate re-roofing. Extend drip lip down 3" (min.). Provide 30# felt under platform cover.

3.7 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.

B. Piping Tests:
1. General: Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the new test. 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. Water Piping: Maintain 100 psig water pressure for 4 hours.

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, National Environmental Balancing Bureau or Testing, Adjusting and Balancing Bureau. The agency shall provide documentation of having successfully completed at least five projects of similar size and scope.

C. Instruments: All instruments shall be accurately calibrated; calibration histories shall be available for examination. Application of instrumentation shall be in accordance with AABC, NEBB or TABB 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 to and reviewed by the Mechanical Engineer prior to the final mechanical construction 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 or TABB 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. Verify that the Controls Contractor has commissioned and documented their work before the TAB work begins.

H. 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.

I. Water Balance Procedure (For Each Pumping System):
1. Set valves for maximum coil flow.
2. Remove and clean all strainers.
3. Examine water in system and determine if water has been treated and cleaned.
4. Check expansion tanks to determine that they are properly charged and that the system is completely full of water. Bleed air from system.
5. Set operating temperatures of all equipment to design requirements.
6. Air balance must be complete before water balance begins.
7. Adjust pumps to design flow by use of differential pressure gage calibrated in feet of water.
8. Adjust water flow through all equipment to design flow.
9. Record leaving and return water temperatures at all equipment. Reset to correct design temperature.
10. Record water temperatures at inlet side of coils. Record rise or drop of temperatures from source.
11. Balance all coils for design flow and mark settings on flow controllers.
12. After coils are balanced, recheck settings at all equipment and readjust if required.
13. Record pressure drop through coils, and reset to design flow. Set pressure drop across bypass valve to match coil full flow pressure drop.
14. Record the following at each coil:
    a. Inlet water temperatures.
    b. Leaving water temperatures.
    c. Pressure drop across coil.
    d. Pressure drop across bypass valve.
15. Record pump suction and discharge pressures at operating condition and also with pump discharge valve completely closed.
16. Record running amperage of pump motor at operating condition and also with pump discharge valve completely closed.
17. Record water metering device readings.

3.9 WATER TREATMENT:

A. General: All new HVAC equipment and auxiliary water piping systems shall be cleaned, passivated and treated as herein specified. Chemical compound identifications are from San Joaquin Chemicals, Inc., a State of California Contractor, License #461677. A written generic formula including active ingredients percentages must be submitted for review to be accepted as equivalent. Provide treatment as required to control scale, corrosion, biological growth, foaming and general fouling. Chemical treatments indicated below are generic in nature, actual formulations, dosages and application shall be determined by analysis of the make-up water to be treated with consideration for the system metallurgy, type of treatment equipment employed and operating units characteristics. Initial cleaning, preparation and start-up shall be supervised by the water treatment company's field service application specialist having a minimum of ten (10) years' experience with these type applications. The water treatment contracting company shall have not less than fifteen (15) years' experience with these type applications.

B. Cleaning and Initial Preparations:

1. Initial Fill: As the first water is introduced into the system, add not less than 10 gallons for each 1,000 gallons of contained water volume of a liquid blend of alkaline detergent; SANASOLV ® 6103 for closed systems, SANACOR ® 2605 -WR metal passivator as a white rust inhibitor for open galvanized systems, and SANACOR ® CUI for metal passivator as an enhanced copper tube corrosion inhibitor, comprised of the following ingredients:

   Closed (Hot, Chilled, Non-Galvanized Open Systems):
   - Sodium Silicate Penta-hydrate
   - Sodium Tri-Polyphosphate
   - Tri-Sodium Phosphate
   - Dispersing Polymers
   - Wetting Agent, non-ionic

   Open (Galvanized Passivator):
   - Ortho-phosphate
   - Poly-phosphate
   - Dispersing Polymers
   - Azole
   - Buffered at pH 7.2-7.8

   Open (Enhanced Copper Tube Passivator):
   - Azole in solution (pH 7.5 to 8.5)

2. Circulation: The above closed loop detergent shall be re-circulated for not less than twelve (12) hours/not more than forty-eight (48) hours after which the system shall be rapidly dumped with re-circulating pumps operating to provide maximum practical motion, and whenever possible, with simultaneously adding or chasing with rinse water. It is important that make-up water rate exceed water discharge rate. In either case, the system shall be flushed until neutral to phenolphthalein, reaches the same pH and TDS levels as the clean flushing water and is free from suspended material and color. Provide circulating pumps as required. If existing main circulating pumps are utilized for flushing the system, the entire system shall be flushed and re-treated.
   a. After flushing, all strainers shall be removed and cleaned. If the system contained a significant level of suspended solids, recirculating pump seal replacement may be required as requested by the project engineer as recommended by the water treatment field service application specialist. These functions will be the responsibility of the mechanical contractor with supervision by the water treatment applications specialist.
   b. Be sure that all heating and/or cooling coils are kept open during the cleaning and flushing process and that cleaning solution is re-circulating through them and totally flushed from the entire system. These functions will be the responsibility of the mechanical contractor with supervision by the water treatment applications specialist.
   c. After flushing cleaner/metal passivator from the open galvanized system, immediately re-passivate galvanized systems with SANACOR® 2605-WR at 10 gallons/1,000 gallons

contained water and leave the passivator in the system to naturally deplete during normal operating blowdown cycles.

d. After flushing cleaner/metal passivator from the open condenser water system, immediately re-passivate these enhanced copper alloy tube systems with SANACOR® 2605-CUI at 10 gallons/1,000 gallons contained water and leave the passivator in the system to naturally deplete during normal operating blowdown cycles.

3. Initial Treatment Closed Loop: As soon as possible after flushing (within two hours), and with clean water in the systems, introduce 800 to 1,200 parts per million of sodium nitrite, pH buffer, yellow metal inhibitor and anti-scalants, (SANACOR® 2301-A) and adjust system water pH to 8.5 - 10.5. Maintain treatment concentration in all closed systems using by-pass feeders; (two-gallon feeders for less than 1,000 gallons contained water and five or twelve-gallon feeder for larger systems.
4. Initial Treatment Open System: Introduce 500-1000 parts per million recommended SANACOR® 2600 series antiscalant/antifoulant/metal passivator/inhibitor to open recirculating water systems. Allow this inhibitor to fall naturally within control limits as recommended by the water treatment applications specialist. This inhibitor does not replace the galvanized or enhanced copper tube passivators that should already be in the systems and allowed to dissipate through normal system bleed-off.

C. Certification Before Start-Up: Equipment shall not be started until the water sides of all units have been cleaned and treated per these specifications under the supervision of the water treatment company's applications specialist. The field service applications specialist or their designate shall prepare a letter and submit it to the mechanical contractor and/or consulting engineer indicating that all piping systems have been properly cleaned and treated and are ready to be put into operation.

D. Continuation of Supervision: The water treatment service company shall provide supervision of the water treatment program for a period of not less than one year from commencement of the water treatment program which shall consist of analysis of all treated systems and the submittal of a written analytical report stating the current conditions and recommendations for maintaining optimal controls. This service shall be performed monthly or more frequently as specified or required.

E. Chemical Supply: Provide a one year (12 months) supply of chemicals from commencement of the water treatment program to maintain the following criteria based on 17 hours operation per day, 7 days a week, at 75% loading capacity. Water treatment contractor must allow for one year supply of chemicals, (including biocides) regardless of the system operating conditions. The only exception: if a closed water system is dumped or takes on more than 10% make-up of its total water volume during the first year, additional required chemicals cost over the 10 % will be reimbursed with proper documentation. Part of this documentation requires water treatment contractors proposed closed system use rate requirements to be supplied with Submittals.

1. Chilled Closed System: Provide and maintain an excess sodium nitrite concentration of 800-1200 ppm by addition of SANACOR® 2301-A. Consider ≅ 10% per year water loss by volume.
2. Hot Water Closed System: Provide and maintain an excess sodium nitrite concentration of 800-1200 ppm by addition of SANACOR® 2301-A. Consider ≅ 10% per year water loss by volume.
3. Condenser Cooling Water: Provide and maintain between 200 and 500 ppm total treatment concentration of recommended SANACOR® 2600 series inhibitor. Inhibitor selection and feed rate will be based on make-up water quality, system metallurgy, projected cycles of concentrations, type of system and environmental compliance requirements.
4. Condenser Cooling Water: Provide biocide (SANATOX® 2080) pelletized bromine/chlorine hydantoin (must be over sixty (60%) percent active as Bromine) to be fed via bypass pot feeder specifically designed for this type oxidizing product. A second and sometimes third liquid non-oxidizing biocide and/or bio-dispersant may be considered based on location, environment, system size and type, etc.
5. Responsibility: It is the responsibility of the water treatment service company to guarantee biological control of each treated system for the first year warranty period. In addition to maintaining corrosion rates less than 1.0 mpy for steel, 0.1 mpy for yellow metals, with no pitting, and total elimination of scaling and/or fouling of all treated systems.

F. Equipment and Accessories:

1. Water Meter: A properly sized pressure regulated back-flow preventer shall be installed in any make-up water line where chemicals may be injected. A properly sized contacting head water meter or a paddle wheel flow sensor (in-line or wall mount with pulse counter) which will signal a chemical pump with both internal and external operating characteristics for feeding inhibitor chemical proportional to real-time system make-up. Seametric MJNR-200 1 pulse/10gal
2. Controller: Controller shall continuously monitor the conductivity of an open cooling water stream via a remote or attached sensor. As the conductivity rises above a pre-set conductivity level as established by the water treatment company, the controller shall signal a N/C motorized bleed valve to open, evacuating high TDS recirculating water. The valve shall remain open until the conductivity drops two to five percent below the pre-set level. The conductivity level shall be adjustable from 100-5,000 micro siemens. Controller shall have operating mode indicator lights, connections for chemical pump, N/C bleed-off valve and shall have a conductivity sensor flow switch and flange for wall mounting, Advantage, Aqua Track, Wal-Chem, Lakewood, Pulsatron, models or approved equal. Walchem WCTT600PSNNM-BN
3. Chemical Pump: Positive displacement pump with variable stroke and frequency, 2.0 gph - 250 PSI, both external and internal input function, acrylic or PVC head as appropriate for the chemical proposed with reinforced, thermoplastic housing. Provide foot valve with strainer, 4-function discharge valve, polyethylene tubing. Advantage, Liquid Metronics, Inc., Walchem or approved equal. Walchem1XB-007TCN-U
4. Biocide/Bio-dispersant Pump: Positive displacement Pump with variable stroke frequency, 2.0 gph – 250 PSI with input function from the controller timer, acrylic or PVC head as appropriate for the biocide, thermoplastic housing, provide foot valve with strainer, 4 function discharge valve, polyethylene tubing. Advantage, Liquid Metronics, Inc., Walchem or approved equal. One pump is required, a second pump will be supplied at the discretion of the water treatment company with E.4. Walchem 1XB-007TCN-U
5. Solenoid/Motorized Bleed Valve: Normally closed, pilot operated diaphragm valve or normally closed motorized, ¾” to 2” pipe size based on projected line pressure and bleed-off rate.Griswold Controls, Model 4160, 115 volt coil, Erie N/C motorized valve or approved equal. GTP-MGV10B/WP
6. Chemical Tank: 65-110-250 gallon polyethylene double walled containment or chemicals resistant powder-coated steel or stainless steel overlay containment of polypropylene chemical bulk container. Proper selection of tank capacity must assure a minimum of three (3) months chemical supply.
   1-DW65-BLUE (INHIBITOR)
   1-DW65-BLUE (BIOCIDE)
7. Brominator: Properly sized for tower capacity to maintain not less than 60 days supply of briquettes during the optimum use period. Include all necessary valves, air vent, calibrated outlet valve, inlet ball valve, calibrated slotted ball valve, drain line, flow meter (2-10 g.p.m. or as required). GTP/BR-40-HP W/MGV10B/WP CPV Moto Valve

G. Analytical Equipment and Reagents:
   Test Master Jr. Test Cabinet, complete or equal
   Myron L 6PIIFC pH/Conductivity/ORP meter
   Sodium Nitrite Drop Test Set
   Open Recirculating Inhibitor Drop Test Set (T. S. 260 or approved equal)
   Bromine/Chlorine Test Set, Color Comparator Type
   Total Alkalinity Drop Test Set
   SANACHECK Bio-Stick Testing
   *All reagents supplied for first year of operation

H. Installation: Install all equipment and accessories per the piping diagrams on drawings and the manufacturer's recommendations as approved by the consulting engineer and under the direction of the water treatment contractor.

I. Electrical: Work in this section must be performed by the electrical contractor under the supervision of the water treatment contractor.

J. Submittal Acceptance: Submittals will not be accepted without annual chemical and biocide use calculations and these calculations must illustrate proper chemical double-walled bulk containment tanks selection and

brominator selection based on the water treatment company's submitted use rate calculation, referring to operating load as specified under E. "Chemical Supply". The water treatment supplier is obligated to supply items specified for one year regardless of their calculations as submitted, with exception under E for closed loop systems.

END OF SECTION

SECTION 23 09 23 - DIRECT DIGITAL CONTROL AND ENERGY MANAGEMENT SYSTEM

PART 1 - GENERAL

1.1 GENERAL MECHANICAL PROVISIONS:

A. The General Mechanical Provisions of Section 23 00 00 shall form a part of this Section with the same force and effect as though repeated here.

1.2 SCOPE:

A. General: The direct digital control and energy management system (DDC/EMS) includes control panels, control devices, valves, actuators, all line and low voltage control and interlock wiring (including wiring to controllers, switches, timers, relays, etc.) and conduit and related equipment, as required for proper operation of all equipment. Provide all equipment, programming, labor, materials and services necessary for a complete, lawful and operating DDC/EMS as shown or noted on the drawings and as specified herein. All control wiring, line and low voltage shall be installed in conduit. Power wiring, power to DDC/EMS control panels and disconnect switches are included in the Electrical Specifications, except that power wiring for control devices such as controllers, valves, etc., is included in the control system. Electrical work shall be in accordance with Electrical Specifications. The system shall be direct digital control/electric. **The control system shall be direct digital. Distech, without substitution, to match existing. The system shall be Niagara 4, HTML5 based, with open license supervisory controller.** The system shall communicate over the District's Ethernet LAN/WAN, and shall include the latest upgrading (software and firmware) during the warranty period. The data wiring shall have an Ethernet connection at the DDC/EMS panel. A Graphical User Interface (GUI) shall be provided. Coordinate with Section 23 00 01, Heating, Ventilating and Air Conditioning and with Division 26. Comply with ASHRAE 55 and Title 24.

1. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work.
2. Coordinate and cooperate with commission agent as required by Section 01 91 13.
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. Contractor Qualifications: All controls shall be furnished and installed by a Contractor who is licensed, N4 certified and approved by the controls manufacturer for design, installation, start-up and service of their product. The Contractor must 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.

C. Submittals: Within 60 days of contract award, submit eight (8) copies of shop drawings showing the following aspects of the DDC/EMS system (CAD file with DXF format if required of floor and site plans can be secured from the Architect).

1. All termination points, terminal cabinets, and cabling.
2. Schedule of input and output points.
3. Locations of all visible DDC/EMS system components (i.e. interior and exterior sensors, terminal strips, panels, trench and pull boxes, etc.), identifying specifically any exposed conduit.
4. Descriptive literature for all material and equipment items shall include manufacturer's name and catalog numbers, dimensions, capacities, and all other characteristics and accessories as listed in the specifications or on the drawings.

5. Submit copies of forms to be used for testing and verification showing all data which is to be recorded. Three copies of complete report shall be submitted for review.
6. Complete written sequence of operation for all controlled equipment.

D. Installation and Operation Manuals: Furnish Installation and Operating 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 alignment and calibration procedures for all components.
4. Detailed schematics and assembly drawings and communication trunk diagram with control unit addresses.
5. BACNet architecture diagrams
6. Sequence of Operations.
7. Controller points lists.

1.3 SYSTEM ARCHITECTURE

A. DDC/EMS Equipment: The main controller shall contain the network communications and information management programs providing integrated global control, trend logging, local and remote alarming and fully menu driven user interface. The local network controller must be an intelligent, stand-alone microprocessor based controller which can have a variety of configurations based on their application.

B. Campus-Wide Data Transfer System: The DDC/EMS shop drawings shall indicate where all equipment items are to be located for input and output to complete the system. The conduit/cabling system shall inter-tie these points as required to complete one system to meet the design criteria herein. Conduit shall be used for all EMS wiring whenever access is limited (hard-lid, walls, etc). When EMS wiring is installed in/above accessible areas (such as T-bar ceilings), free-air with J-hooks and wire-ties is acceptable. However, EMS wiring cannot be intermixed or bundled with any other cabling/wiring (Fire Alarm, internet, etc). System high speed communication shall be hardwired using a Belden shielded cable as recommended by DDC manufacturer.

C. User Interface Communication: The user may communicate with the DDC/EMS system with a workstation located at the District Office over the WAN, with a remote workstation, with an On-Campus Operator Workstation, or with a Lap-Top computer (Service Tool).

D. Standard Network Support: All Master Controllers, Workstation(s) and File Server shall be capable of residing directly on the owner's Ethernet TCP/IP LAN/WAN. Furthermore, the Master Controllers, Workstation(s) and File Server shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers, switches and hubs. With this design the owner may utilize the investment of an existing or new enterprise network or structured cabling system. This also allows the option of the maintenance of the LAN/WAN to be performed by the owner's Information Technology Department as all devices utilize standard TCP/IP components. If the DDC/EMS contractor needs an additional data port that is not already provided, its installation must be coordinated with the District's IT department (and IT infrastructure contractor if applicable) and shall be installed at the DDC/EMS contractor's expense. As a result, the DDC/EMS contractor shall ensure any additional data port locations are clearly indicated and that the existing EMS data ports they intend to utilize are addressed/identified prior to construction so they are not damaged or removed. This coordination shall occur between the District's Construction Office, IT department, DDC/EMS operator, IT infrastructure contractor (if applicable), and the project's general construction contractor manager.

PART 2 - PRODUCTS

2.1 GENERAL:

A. General Requirements: The Electronic Microprocessor Based Direct Digital Control and Energy Management System (DDC/EMS) shall monitor the data environment and perform control functions in relation to a programmed strategy and the status of the data environment. The system shall use solid state computer based digital and analog technology. The system shall be standard with the manufacturer to insure on going parts availability and trained technical support. The DDC/EMS shall be of the user programmable type requiring no special computer education for operation. All necessary instruction manuals and user orientation training shall be supplied by the manufacturer or agent thereof. The DDC/EMS shall be UL listed as a Direct Digital Control and Energy Management System. The programmable control requirements of the DDC/EMS shall include, but not be limited to:

OPTIMUM START/STOP (BASED ON HISTORICAL DATA)
TIME OF DAY ROUTINES
SCHEDULED OCCUPANCY ROUTINES INCLUDING HOLIDAYS
CUSTOM TAILORED REPORTING
ACCUMULATING RUN TIME
CRITICAL CONDITION ALARMING
FLUID FLOW SWITCH AND CONTROL ALARMING
PID CONTROL ON ANALOG OUTPUTS
HOT WATER RESET
DAY/NIGHT SETBACK
ECONOMIZER/PURGE
CUSTOM TAILORED REPORTING
ACCUMULATING RUN TIME
POINT OVERRIDE ABILITY FOR EVERY DIGITAL AND ANALOG OUTPUT
SEPARATE MODES AS REQUIRED BY CONTROL SEQUENCE
ALL EXTERIOR LIGHTING CIRCUITS CONTROLLED BY SYSTEM

B. Environment: The DDC/EMS shall operate in an environment of 40 120 degrees F and 10 95% relative humidity. Sensors and control elements shall operate under the temperature, pressure, humidity, and vibration conditions normally encountered in the installed location. The DDC/EMS shall maintain accuracy as follows:
1. +/ 0.5 F for the space temperatures in the 0 F 130 F range.
2. +/ 0.5 F for duct temperatures in the 40 F 130 F range.
3. +/ 1.0 F for outside air temperatures in the 30 230 F range.
4. +/ 1.0 F for water temperature in the 30 230 F range.
5. KWH and KW monitoring within 1.0%.

C. Battery Backup: The system shall be tolerant of power failure and hold memory for a minimum of 12 hours. On power restoration, the system shall automatically and without operator intervention of execution of manual restart procedures:
1. Come On Line.
2. Update all monitored functions.
3. Resume operation based on current time and status.
4. Implement special building start up strategies as required.
5. Log time of power outages and start ups.

D. Program Storage: All JACE 8000 hardware licenses and certificates shall be stored on local MicroSD memory card employing encrypted “safe boot” technology.

E. Protocol: Protocol shall be BACNet. The Main Controller shall be enabled to support and shall be licensed with the following Open protocol drivers (client and server) by default.
1. BACNet
2. Lon
3. Modbus
4. SNMP
5. KNX

F. The Main Controller shall provide the following hardware features as a minimum:
1. Two 10/100 Mbps Ethernet ports.
2. Two Isolated RS-485 ports with biasing switches.
3. 1 GB RAM
4. 4 GB Flash Total Storage / 2 GB User Storage
5. Wi-Fi (Client or WAP)
6. USB Flash Drive
7. High Speed Field Bus Expansion
8. -20-60°C Ambient Operating Temperature
9. Integrated 24 VAC/DC Global Power Supply
10. MicroSD Memory Card Employing Encrypted Safe Boot Technology

G. The Main Controller shall be provided with a 5 Year (SMA) Software Maintenance Agreement. Labor to implement not included.

2.2 SYSTEMS DESCRIPTION:

A. Modular Design/Expandability: The DDC/EMS shall be of a modular design providing distributed processing capability, and allowing future expansion of both input/output points and processing/control functions. The modular DDC/EMS shall be configured on the main/local concept. The main controller shall have the capability of adding local controllers and the local controllers shall be capable of adding I/O modules.

B. Main (Master) Description: The master shall function as the overall system coordinator, accept control programs, perform automated energy management functions, control peripheral devices and perform all necessary mathematical calculations. The master shall be a microcomputer of modular design. The word size shall be 16 bits or larger, with a memory cycle time less than 1 microsecond. All chips shall be second sourced. The master shall have the following:
1. Protected Access: Key lock protected access to output override switches and internal circuitry.
2. Memory: The master shall have memory required for systems operation and diagnostics or MCP software.
3. Real Time Clock: The master shall have a battery backed uninterruptable "Real Time Clock". The accuracy shall be within ten seconds per day. The RTC shall provide the following information: Time of Day, Day, Month, Year, and Day of Week. The system shall be programmed to automatically correct the clock for day light savings time and leap years and Time Sync.
4. Power: The master shall operate from 120 VAC +/- 20%, 60 Hz. Line voltages below the operating range of the system shall be considered outages. The master shall have over voltage surge protection, and require no additional AC power signal conditioning.
5. Parallel Processing: The master shall be capable of parallel processing, executing separate control programs simultaneously. Any control program may affect control of another program if desired. Each program shall have full access to all I/0 facilities of the processors.
6. Communications Processor: Each master shall provide communication to the District’s Workstation(s) (LAN) and the field buses. In addition, each master must have communications ports that support portable service tool and connection to third party controllers such as a chiller control panel or Variable Frequency Drives.

7. Uninterruptable Functions: Control functions shall not be interrupted due to program entry or other user communications.

C. Local Controller Units: The local units function as a stand-alone controller and as an Input/Output interface of the DDC/EMS and the Data Environment.
1. HVAC units must be fully controlled by a controller connected to the DDC/EMS that can be fully programmed by the DDC/EMS contractor.
2. Monitoring: Local units shall be used to connect the data environment to the system and contain all necessary Input/Output functions to read field sensors and operate controlled equipment based on internal instructions or instructions from the Master. The units shall be fully supervised to detect failures. The units shall report the status of all points in its data environment at the rate of at least once every second. Local units shall connect directly to the Master with a twisted pair shielded RS-485 interface.al unit failure.
3. Unit Failure: Upon failure of the unit (including transmission failure), the unit shall automatically fail off or to a predetermined state for three-way valves. All local units must run independently in the event of a central unit failure (including transmission failure) in bypass mode via the thermostat.
4. Power: The unit shall operate from 120 VAC, +/-20%, 60 Hz, 220 VAC, +/-20%, 50 Hz or 24 VAC +/- 20%, 50/60 Hz power. For voltages below the operating threshold the unit shall totally shutdown and de energize its outputs.
5. LAN and/or Field Bus: Each unit shall communicate with any unit through the RS-485 interface LAN and/or field bus.
6. Auxiliary Port: Each unit shall be equipped with an auxiliary port to allow local interrogation of input and output values, and keyboard override of outputs through laptop.

2.3 INPUT/OUTPUT CAPABILITY:

A. Inputs: The DDC/EMS shall accept information in the form of a temperature, voltage, digital signal (on off) or pulse counter.
1. Analog Inputs: The Analog Input (AI) function shall monitor each analog input, perform A/D conversion, and hold the digital value in a buffer for interrogation. The A/D conversion shall have a minimum resolution of 10 bits. Input ranges shall be within the range of 0-10 VDC.
2. Digital Inputs: The Digital Input (DI) function shall accept dry contact closures and voltage level or resistance level (5VDC reference voltage) transitions. A voltage level below 1 volt or a resistance below 500 ohms shall be read as ON (closed), a voltage level above 3 volts or a resistance above 1400 ohms shall be read as OFF (open).
3. Pulse Accumulator Inputs: The pulse accumulator function shall have the same characteristics as the DI, except that, in addition, a buffer shall be included to totalize pulses between interrogations. Each input shall accept pulses at a minimum of 2 per second.
4. Temperature Inputs: Temperature inputs originating from a thermistor, shall be monitored and buffered as an AI, except that, automatic conversion to degrees F shall occur without any additional signal conditioning.
5. Input Wiring: All analog inputs shall be two wire devices, with shielded wire for accurate operation.

B. Outputs:
1. Master and local controllers - Form C relay outputs rated at 5 amp, 24 VAC/DC or 2 amp, 30 VAC for on/off or Pulse Width Modulation for maintained operation of field devices. Output pulse width shall be selectable between 0.1 and 3200 seconds with a minimum resolution of 0.1 seconds. Isolation and protection against voltage surges shall be provided. Central plant controllers shall be equipped with an ON/OFF/AUTO switch to manually obtain either output state. Manual overrides shall be reported to the master at each update. An LED shall be provided to indicate the state of each digital output.

2. All digital and analog output points on every controller must have an override (highest priority) input point in the controller's point list in the JACE. This override point must be clearly labeled and identifiable. For example, "DO1ovrd" would be the point to override Digital Output 1.

2.4 SOFTWARE:

A. User Software: HTML5 based. Provide software (required upgrades) for Laptop Computer (Service Tool) and District office workstation, as required.

B. Software Features:

1. Mathematical Requirements: The DDC/EMS shall have a math package capable of addition, subtraction, multiplication, division, square root, greater than and less than functions, minimum and maximum selection functions, and up to five levels of parenthesis for computation of variables. Control commands may be executed based on these calculated variables which are available to the program on a global basis. Math expressions may be used in action and exit commands of control program. The mathematical software shall be capable of mixed mode arithmetic, utilizing Boolean logic statements in combination with basic arithmetic to provide conditional mathematical computations.
2. Passwords: The DDC/EMS shall have multiple levels of user programmable passwords in addition to a master password, for programming security. Separate passwords may be user programmed. Level of password will define user's access level and ability to change system.
3. Trend Logging: The DDC/EMS shall trend log variables. Any system variable (inputs, outputs, numerals, can be trend logged.
4. Messages: The DDC/EMS shall provide alarming, preventative maintenance and status reporting messages.
5. Documentation Format: The programming language of the DDC/EMS shall be plain English based such that a printout of the control program shall serve as the primary documentation for the system.
6. Micro Processor Integrity Checking: Each DDC/EMS microprocessor shall continuously monitor and check itself and produce error messages in the event of a malfunction.
7. Data Plotting: The DDC/EMS shall provide plots of values of system variables on a graph. Graphs may consist of combinations of up to 3 system variables at a time from the history logs.

C. Color Graphics Requirements Provide HTML5 based color graphics which allow user to access and change (based on user access level) all schedules and setpoints (including damper or control valve positions) directly through the user graphics. Real time data shall continuously be updated. Navigation between the screens (forward and backwards) shall be accomplished with the use of a mouse. 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 1 screen per building plus site and others as needed for clarity. By "clicking" mouse on the desired equipment area a flow diagram will be displayed for the related equipment (as described below - Item 2). By "clicking" the mouse on a conditioned space, a graphic display of the zone conditions (as described below - Item 3) will be displayed.
2. Each building must have a graphical summary page of all the zones in that building that displays zone temperature, set point, discharge air temperature, and fan command.
3. Zone & HVAC Equipment Description on GUI: Each item of HVAC equipment must be clearly identified by what area it serves and its unit number. For example, if HC-2A serves Classroom 4, the GUI should list it as "Classroom 4, HC-2A." It should NOT be listed as only "HC-2A" or "Classroom 4."
4. 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, brine system with all inputs and outputs dynamically displayed.

5. Each temperature control zone shall have a screen providing set points, temperatures, and related HVAC system status data.
6. Scheduling screens allowing On/Off times to be set.

D. Software Manual: The software manual shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software feature. The manual shall instruct the user on programming or reprogramming any portion of the system. This shall include all control programs, variables, set points, time periods, messages, passwords and other information necessary to load, alter, test and execute the system. The manual shall include commands, editing and writing control programs, printouts and logs, mathematical calculations, and instructions on modifying any control point, verifying error status, changing passwords, and initiating or disabling control programs.

E. Software Licenses: The owner shall be named the license holder of all software associated with any and all incremental work on the project(s). All Niagara 4 software licenses shall have the “accept.station.in=*”; “accept.station.out=*”; “accept.wb.in=*”; and “accept.we.out=*” section of the software licenses. The intent is to insure that the installed Niagara 4 products may be completely open for integrations. Owner shall be free to direct the modification of the software license, regardless of supplier. In addition, the Owner shall receive ownership of all job-specific software configuration documentation, data files, and application-level software developed for this project. This shall include all custom, job-specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use within Niagara Framework (Niagara 4) based controllers and/or servers and any related LAN/WAN/Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the Owner.

2.5 USER INTERFACE:

A. LAN Connections: If an additional LAN connection is needed, the conduit and cable from LAN rack is to be installed by electrical contractor. The planned location of all LAN connections (new and existing) to EMS equipment must be coordinated with the District’s networking staff and EMS staff as early as possible. Final connections shall be made by DDC/EMS Contractor.

B. Direct Computer Communication: The DDC/EMS shall have a computer compatible communication mode for communication with other intelligent devices, which performs data integrity checking, with automatic retransmission of data when errors are detected.

C. JACE software must include all applications to make all folders viewable and accessible in the JACE.

2.6 SYSTEM COMPONENTS:

A. Control Components:
1. Wall Switches: Plates for all wall switches and timers shall match those specified in Division 26.
2. Labels: All labels, signs, etc. shall be engraved, laminated plastic, white on black background, 1/8" high lettering, minimum.
3. Temperature Sensors:
   a. Sensor Type: All temperature sensors shall be made of a highly stable, precision thermistor material accurate to within $\pm$0.36 Degrees F. Identify each temperature sensor with a "Lamicoid" label keyed to the control system as-built drawings.
   b. Room Sensor: Room temperature sensor shall have Executive Decorator housing with programmable visible temperature indication. Housing shall include an occupancy override, temperature setpoint adjustment and a service tool jack.
   c. Vandal Resistant Room Sensor: Where noted, shall be a blank stainless steel wall plate with the sensing element bonded to the back side. The plate back shall be insulated to reduce wall temperature influence.

d. Duct Sensor: Duct temperature sensor shall be a probe type element with 9 inch insertion length. Element shall be installed where air mixture provides a true temperature indication. Where adequate mixing is not practical, the duct temperature sensor shall have an averaging type thermistor element, installed across the entire cross section of the duct.

e. Outdoor Air Sensor: Outdoor air temperature sensor shall be a probe type element mounted in a ventilated, treated white PVC sun shield to minimize radiant energy effects. The sensor and sun shield shall be mounted on a weatherproof outlet box for outdoor installation.

f. Low Differential Air Pressure Applications (0" to 5" W.C.): The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points. Non-interactive zero and span adjustments, adjustable from the outside cover. (0.00 - 1.00" to 5.00") W.C. input differential pressure ranges. 4-20 mA output. Maintain accuracy up to 20 to 1 ratio turndown. Reference Accuracy: +0.2% of full span.

g. CO2 Sensor: The sensor shall have a five year recommended calibration interval. In addition, the sensor shall be provided with a five-year calibration guarantee, providing for free factory replacement if the sensor is found to be out of calibration within five years of the purchase date. The sensor shall have accuracy of ±50 ppm and repeatability of ±20 ppm. All adjustments to the sensor including output scaling, elevation adjustment, relay set point, relay dead-band, linear or exponential output, and single point calibration shall be made via on-board push buttons and LCD display. The LCD display must be covered by a solid door and only viewable when the door is opened for adjustments.

4. Temperature Control Panels: Each panel and each control device or readout on the front of the panel shall be identified with a laminated plastic label with 1/4" high engraved lettering, white on black background. Pilot lights shall be the push to test type.

5. Smoke Detectors: Furnished and installed by Division 26. Power and fire alarm wiring by Division 28. Control wiring by Division 23. Coordinate with Division 26.

6. Status Sensor: Current sensing status sensor (with sensitivity adjustment for belt loss detection).

7. Electric Actuators:
   a. General: Fully modulating, UL listed. Visual position indicator, manual override and clear weather shield where exposed to weather. 24 volt. Belimo.
   b. Valve Actuators: Provide with factory mounting brackets and linkage to the control valve. Capable of shutting off against a 50 psi differential.
   c. Damper Actuators: Positive position feed back and spring return. OSA dampers shall be spring return closed. Actuators shall be direct mounted onto the damper control shaft without linkage. Damper actuators shall be sized to provide a minimum of 5 in-lbs torque per square foot of damper face area.

8. VFD:
   a. General: The variable frequency drive (VFD) shall be a completely adjustable frequency motor drive system consisting of a pulse width modulated invertor for speed control of NEMA Design B induction motors. Variable frequency drives shall be manufactured by a single source. The VFD manufacturer shall have a minimum of five years experience in VFD design. Asea Brown Boveri (ABB). Alternate manufacturers shall submit names, addresses and phone numbers of at least five installations in the immediate area. Provide factory start-up.
   b. Standards: VFD shall be in accordance with the latest revisions of the following:
      1) IEEE Standard 519, Guide for Harmonic Control and Reactive Compensation for Static Power Converters
      2) UL Standard 508, Electrical Industrial Control Equipment
      3) VFD shall be UL listed and bear the UL label.
   c. Design Requirements: The VFD shall be capable of operating in the following conditions: ambient temperature 0 to 40 degrees C and relative humidity 0 to 95%, noncondensing.

The power section shall allow the following faults to occur without damage to the VFD: single-phase fault, three-phase short circuit, or phase to ground short circuit. VFD shall include the following features: overcurrent protection, overspeed protection, over temperature protection, electronic thermal motor protection. NEMA 1 or 4 enclosures, as applicable. Provide line reactors, 3% impedence, for all VFD's. Provide load reactors where load side circuit lengths exceed 200 feet.

d. Adjustments: VFD adjustments shall be set via menu driven selections accessible from the front panel. The VFD shall operate in the auto or manual mode and shall include the following front panel mounted switches and indicators:
   1) 2 line x 14 character alphanumeric display
   2) Local/ remote switch.
   3) Digital indicator of frequency, current, volts, torque, HP, KW, KWhrs and run hrs.
   4) Manual speed control
   5) Run / stop switch.
   6) Power on and run indicator
   7) Fault indication including: current limit, overvoltage, undervoltage, overload or thermal motor protection.

9. Pressure Independent Control Valves (VAV Boxes):
   a. General: The control valves shall be pressure independent. Fail safe actuator. The control valves shall accurately control the flow from 0 to 100% full rated flow with an operating pressure differential range of 5 to 50 PSI differential across the valve with a valve body accuracy of +/- 5% variance due to differential pressure fluctuation or +/- 10% total assembly error incorporating differential pressure fluctuation, manufacturing tolerances and valve hysteresis. Sensor is powered by the actuator. Belimo ePIV.
   b. Valve Bodies: Forged brass body and sensor housing (nickel plated), rated at no less than 360PSI, stainless steel ball and stem, female NPT union ends, dual EPDM lubricated O-rings and a brass or TEFZEL characterizing disc.
10. Control Valves:
   a. General: Equal percentage or linear flow characteristics. Unless otherwise noted, select for 2-4 psi pressure drop across the valve at the specified flow. Belimo. 2" and smaller shall be screwed connection, globe or ball valve. 2-1/2" and larger shall be flanged connection, globe or butterfly valve.
   b. Ball Valve: Stainless steel ball and stem, teflon seat and O-rings. 400 psi WOG. Packing shall be reinforced teflon seal washer and stuffing box ring. Stem packing gland screw shall be adjustable for wear. Factory flow characterization disk.
   c. Globe Valve: Contoured plugs for linear control. 316 stainless steel stem, replaceable seat and adjustable operating range. Packing shall be molded BUNA-N. Valves controlling terminal units or above ceilings shall be of the packless type with bellow seal, or spring loaded teflon requiring no packing maintenance. 2" and Smaller: Bronze body, 250 psi WOG. 35 psi maximum working pressure differential. 2-1/2" and Larger: Cast iron body, 125 psi WOG. 25 psi maximum working pressure differential.
   d. Butterfly Valve: Cast iron body, full lug style (with lugs drilled and tapped for isolation and removal of downstream piping), one-piece 416 stainless steel stem, aluminum bronze disc and EPDM or BUNA-N seat to match application. 175 psi WOG. Packing shall be molded BUNA-N.
11. Energy Valves (Air Handlers):
   a. General: The control valves shall be pressure independent. Fail safe actuator. The control valves shall accurately control the flow from 0 to 100% full rated flow with an operating pressure differential range of 5 to 50 PSI differential across the valve with a valve body accuracy of +/- 5% variance due to differential pressure fluctuation or +/- 10% total assembly error incorporating differential pressure fluctuation, manufacturing tolerances and valve hysteresis. Sensors are powered by the actuator. Belimo EV.

b. Valve Bodies: Forged brass body and sensor housings (nickel plated), rated at no less than 360PSI, stainless steel ball and stem, female NPT union ends, dual EPDM lubricated O-rings and a brass or TEFZEL characterizing disc. 2-1/2" and larger shall have cast and ductile iron bodies.

12. Mitsubishi Controller. CITY MULTI Controls Network (CMCN) controller with on-site LCD and internet IP accessibility. BACnet interface module.
13. Mitsubishi Room Sensor/Controller: Shall be wall mounted "in-room" wired remote controller.

B. Conduit: Conduit to be a minimum 1" diameter, and to have at least 25% spare capacity, except drops to room sensors may be run in ½" conduit. Conduit shall be run in electrical or mechanical trenches wherever possible. Site conduit (building to building) will be installed (and terminated inside the building) by Division 26.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION:

A. General: All electrical work shall be in accordance with the California Electrical Code and the Electrical Specification Sections. All electric/electronic systems shall be hardwired in conduit, except as specifically allowed by 1.3, B. Wiring shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed wiring 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. Provide a 120 volt circuit for each device requiring external power. Dedicated circuits shall be provided where required. Any devices or wiring exposed to the weather shall be protected in weatherproof enclosures such as NEMA 3R and weatherproof conduit.

B. Labeling of System: DDC/EMS Contractor shall provide complete labeling of all terminals at all panels or equipment terminal strips and wiring. Equal to Brady marking on wires and number on terminals in sequence corresponding to control diagram.

C. Programming:
1. The Direct Digital Control and Energy Management System (DDC/EMS) operational program shall be provided by the DDC/EMS Contractor. The DDC/EMS Contractor shall be responsible for programming the system and shall coordinate the scheduling (on/off times) with the Owner. Prior to start-up, the DDC/EMS Contractor shall provide any testing program he feels necessary to fully test the operation of the various components.
2. The DDC/EMS Contractor shall load the operational program into the DDC/EMS controller from his office via the District's network (via VPN) or at the job site via a direct connect cable. Prior to starting up the system, the DDC/EMS Contractor shall:
   a. Confirm that the control system has been connected to the District's LAN/WAN and that the LAN/Wan is working.
   b. Confirm the functionality of the DDC/EMS controllers and all input points by reading the input values, and comparing them with a measured temperature, pressure, voltage, current, or resistance as appropriate. Calibrate all transducers as required.
   c. Confirm the functionality of all digital output points by manual operational of the relay contacts. Use proper discretion in starting and stopping equipment.
   d. Confirm the functionality of all analog output points by manually imposing an adjustable voltage on the appropriate circuit to check proper operation of the controlled device. Calibrate all transducers as required.
   e. The DDC/EMS Contractor shall notify the General Contractor (one week in advance of) when the system will be ready for loading and testing the operational program. The DDC/EMS Contractor's start-up technician shall be present while the program is being

loaded and shall communicate with the programmer prior and after program loading to confirm proper operation.

D. Training: Prior to final acceptance, the DDC/EMS 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. The DDC/EMS Contractor shall maintain a log of training sessions including dates, times and names/titles of those attending. The DDC/EMS Contractor shall submit a copy of this log on request. Contractor shall provide 1 week factory certified training schedule and class at owners' discretion.

E. Testing and Acceptance: The DDC/EMS Contractor shall furnish a complete and operating system. The DDC/EMS Contractor shall also 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, installation and Operation Manuals and other documentation as required to describe the system.
5. Complete operator training in the use, programming, and operation of the system.

F. Start-up of the System:
1. The start-up period starts when the following conditions are met:
   a. The DDC/EMS system and all involved HVAC equipment have been installed, connected to the DDC/EMS system and are ready to operate.
   b. A start-up meeting has been conducted with representative of the General Contractor, Architect/Engineer, maintenance staff, and the DDC/EMS Contractor.
   c. Consensus is reached, by the representatives at the above referenced meeting that it is appropriate for the start-up process to start.
2. The alarm pagers called by the control system during the start-up period shall be the pagers carried by the Mechanical Contractor and/or DDC/EMS Contractor as appropriate. The Mechanical Contractor and DDC/EMS Contractor shall respond to all pages from the control system and work cooperatively to insure that the building environmental standards are maintained.
3. The start-up process shall be completed and the warranty period shall start when the following conditions are met.
   a. All training to be provided as part of the project has been completed.
   b. No "alarm" or "condition reports" are being generated by the DDC/EMS system for seven (7) calendar days (168 hours) due to incomplete or inaccurate installation or programming.
   c. All adjustments and "fine tuning" of the system have been completed.

G. Verification: A written testing and start-up report must be submitted for approval before acceptance. In addition to the DDC/EMS Contractor's testing and start-up report, the Owner may independently verify the test results. The report on test results shall include setpoints and operating ranges of all components.

3.2 SEQUENCE OF OPERATION: The below sequences of operation are to be used as a primary guideline for DDC/EMS control logic sequence development. Any/all variations from the below operation sequences must be approved by the District's DDC/EMS operator prior to implementation. All fans providing ventilation to meet minimum outside

air requirements shall run continuously during occupied hours. Airside equipment (air handlers, etc.) shall start by normally open relay and signal from DDC/EMS.

A. Provide graphics meeting District standards using the existing control sequences for the Central Plant and as indicated below.

B. System Operation Schedule: The central plant shall operate at the schedule set by the District.

C. Central Plant Equipment: The campus circulation pumps shall be started/stopped by the BAS or manually. The pump speed shall be modulated to maintain a minimum pressure as reported by the pressure transmitters. The lead pump shall be cycled to 80% of capacity. When the system demand exceeds this set point the lag pump shall be started and the two pumps track in unison to maintain system pressure. Ramp down sequence shall be in reverse order. The lead/lag pumps shall be alternated on a run time basis (adjustable) by the BAS, or by manual selector switch. Pressure transmitters shall be located as shown on the plans. At the differential pressure sensor locations for the chilled and hot water piping, provide an engraved plastic tag indicating “PRESSURE SENSOR”. On the pressure sensor, provide a brass tag indicating “PRESSURE SENSOR FOR DISTRIBUTION PUMP CONTROL”.
   1. Heat Pump Boiler: The boiler pump and heat pump boiler are started by a signal from the BAS and operate continually until BAS shut-down by either time schedule or by outside air temperature rise to 65 degrees F (adjustable). Boiler pump shall continue to run for 15 minutes (adjustable) after heat pump boiler shut down.
   2. The heat pump boiler shall be interlocked with a flow switch to insure flow. The boiler temperature is controlled by the boiler thermostat.
   3. A 2-way isolation valve in the heat pump boiler inlet shall be interlocked with the heat pump boiler. It shall be closed when the heat pump boiler is off.
   4. Heating hot water reset control: (Initial set point 140°F). Main loop water temperature shall be BAS controlled. The main loop reset temperatures as controlled by BAS shall be adjustable. The BAS shall check the opening positions of all hot water control valves every 10 minutes (adj.). When any valve opens to 95% of maximum, the loop temperature shall reset to 2°F above previous set point. The maximum set point is 140°F (adj.). If any hot water control valve on the system with the greatest opening position below 85% (adj.) of maximum opening, the loop temperature shall reset to 2°F below the previous set point. The minimum set point is 120°F (adj.)
   5. Chiller: Chiller and pumps are started by BAS and upon proof of evaporator and condenser flow the chiller is allowed to operate on its internal controls to maintain chilled water temperature. Provide control boards, wiring and programming for the chiller to allow the District maintenance and EMS departments to monitor the chiller operations through the micro-processor that is built into the chiller. Provide front end control boards and dedicated communication/control wiring as required.
   6. The chilled water pump starts by BAS signal and operates continually until BAS shut down. Chilled water pump to run for 15 minutes (adjustable) after chiller shut down.
   7. Cooling chilled water reset control: (Initial set point 44°F). Main loop water temperature shall be BAS controlled. The main loop reset temperatures as controlled by BAS shall be adjustable. The BAS shall check the opening positions of all chilled water control valves on the system every 10 minutes (adj.). When any valve opens to 95% of maximum, the loop temperature shall reset to 1°F below previous set point. The minimum set point is 44°F (adj.). If the coil control valve on the system the greatest opening position is below 85% (adj.) of maximum opening, the loop temperature shall reset to 1°F above the previous set point. The maximum set point is 50°F (adj.)

D. Air Handler:
   1. General: The unit shall be activated by the BAS. The unit shall be capable of an economizer cycle. A static pressure sensor located 2/3 of the distance down the supply ductwork shall cause the VFD to vary the air volume of the supply fan to maintain a constant duct pressure. A static pressure sensor located in the return ductwork 2/3 of the distance from the most remote return

grille towards the return/exhaust fan shall cause the VFD to vary the air volume of the return/exhaust fan to maintain a constant return duct pressure.

2. Minimum Outside Air Control: The DDC shall modulate the outside air and relief dampers to maintain the required minimum outside air (except in economizer mode), proportional to the signal used to control the supply fan speed. The outside air damper positions shall be developed in coordination with the Balancing Contractor. One set point shall be with the supply fan VFD setting for maximum scheduled air flow. The outside air dampers shall be adjusted to provide the minimum scheduled air flow with the VFD at this position. The second set point shall be with the supply fan VFD setting for minimum scheduled air flow (30% of maximum air flow). The outside air dampers shall be adjusted to provide the required minimum air flow with the VFD at this position. The relief dampers shall also be set using this procedure. See notes at drawing schedule regarding demand control ventilation with CO2 sensors.
3. Heating: (Initial leaving air temperature set point 85°F) On system startup, if the thermostat calls for heating, the outside air (OSA) damper is closed, the relief damper is closed and the control valve is fully open. As the space temperature approaches set point, the OSA and relief dampers open and modulate to provide minimum outside air.
4. Cooling and Ventilation: (Initial leaving air temperature set point 55°F) A temperature sensor downstream of the cooling coil shall modulate the system to maintain a downstream supply air temperature of 55°F (adj.). The first source of cooling is the outside air in Economizer mode. When the outside air temperature is below 55°F, the outside air damper shall modulate to maintain set point. When the outside air temperature is 55°F to 75°F, the outside air shall open fully, and the cooling coil control valve modulates to maintain set point. When the outside air is above 75°F then the outside air damper closes to minimum position, and the control valve shall modulate to maintain set point.
5. Purge Cycle: At 4:00 a.m. during the cooling season between April 15 and October 15, if the room temperature exceeds the outside air temperature, the unit shall run with the outside air and relief dampers 100% open. The unit shall stop and the OSA and relief dampers shall close when the room temperature is within 2 degrees of the OSA temperature.
6. Off Cycle: The outside air and relief dampers go to the closed position and the fans shut off.

E. Split-System Heat Pump (IDU/ODU): Shall be activated by BAS. Unit shall be controlled by integral controls. Provide temperature sensor for the area being controlled and status sensors for indoor and outdoor units.

F. Exhaust Fans: Refer to schedules.

G. Equipment Shut Down: Where noted on schedules, smoke detectors shall shut down units when smoke is detected and signal fire alarm system.

H. Domestic Hot Water Circulating Pump: Shall start/stop by BAS signal. Current sensor shall report pump status to BAS.

I. Fire/Smoke Damper: Close the fire/smoke damper on alarm and shut down the air moving equipment serving the damper and signal fire alarm system.

J. Lighting: integrated with nLight by others.

K. Provide monitoring points for the following plumbing equipment:
WH-1 Water Heater: Run Time, Alarm
P-1 Domestic Water Booster Pump: Alarm

L. Outside and Return Air Damper Minimum Airflow Set Points: The Control Contractor shall set the outside air damper position airflow set points per design and air balance.

1. CO2 Reset of Minimum Outside Air: The reset of the minimum outside air setpoint shall be based on the CO2 sensor with the greatest demand.
2. CO2 Sensor Set Points: The Control Contractor shall determine the base ambient CO2 concentration level after the air handler system has been balanced and the building is unoccupied. The upper and lower CO2 concentration set points shall be developed as follows:
   The lower CO2 concentration set point shall be 200 ppm (adj.) above the base ambient CO2 concentration level.
   The upper CO2 concentration set point shall be 600 ppm (adj.) above the base ambient CO2 concentration level.

END OF SECTION

SECTION 260573
POWER SYSTEM STUDIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.

1) Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.2 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

G. NEMA MG 00001 - Motors and Generators; 2024.

H. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1) Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.

2) Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.

3) Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Pre-Study Meeting: Conduct meeting with Owner to discuss system operating modes and conditions to be considered in studies.

C. Sequencing:

1) Submit study reports prior to or concurrent with product submittals.

2) Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

3) Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).

D. Scheduling:

1) Arrange access to existing facility for data collection with Owner.

2) Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Field testing agency's qualifications.

C. Study reports, stamped or sealed and signed by study preparer.

D. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.

1) Include characteristic time-current trip curves for protective devices.

2) Include impedance data for busway.

3) Include impedance data for engine generators.

4) Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

5) Include documentation of listed series ratings upon request.

6) Identify modifications made in accordance with studies that:

a) Can be made at no additional cost to Owner.
b) As submitted will involve a change to the contract sum.

E. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

F. Site-specific arc flash hazard warning labels.

G. Field quality control reports.

H. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

I. Project Record Documents: Revise studies as required to reflect as-built conditions.

1) Include hard copies with operation and maintenance data submittals.

2) Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.5 POWER SYSTEM STUDIES

A. Scope of Studies:

1) Perform analysis of new electrical distribution system as indicated on drawings.

a) Include portions of electrical distribution system designated as "future."

2) Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).

3) Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

a) Known Operating Modes:
Utility as source.
Generator as source.
Utility/generator in parallel.
Bus tie breaker open/close positions.
Maintenance settings.
_____.

B. General Study Requirements:

1) Comply with NFPA 70.

2) Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:

1) Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.

a) Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
Obtain up-to-date information from Utility Company.
Utility Company: As indicated on drawings.
b) Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
c) Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 00001 code letter designation.
d) Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
e) Protective Devices:
Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).

Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).

f) Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.

g) Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

2) Existing Installations:

a) Provide the services of field testing agency or equipment manufacturer's representative to perform field data collection.

b) Collect data on existing electrical distribution system necessary for completion of studies, including field verification of available existing data (e.g. construction documents, previous studies). Include actual settings for field-adjustable devices.

c) Available Existing Data:

_____.

D. Short-Circuit Study:

1) Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.

2) For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:

a) Maximum utility fault currents.

b) Maximum motor contribution.

c) Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3) For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:

1) Comply with applicable portions of IEEE 242 and IEEE 399.

2) Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3) Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination.

F. Arc Flash and Shock Risk Assessment:

1) Comply with NFPA 70E.

2) Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.

a) Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.

b) For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.

3) For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.

4) Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:

a) Maximum and minimum utility fault currents.
b) Maximum and minimum motor contribution.
c) Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:

1) General Requirements:

a) Identify date of study and study preparer.
b) Identify study methodology and software product(s) used.
c) Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
d) Identify base used for per unit values.
e) Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
f) Include conclusions and recommendations.

2) Short-Circuit Study:

a) For each scenario, identify at each bus location:
Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
Fault point X/R ratio.
Associated equipment short circuit current ratings.
b) Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.

3) Protective Device Coordination Study:

a) For each scenario, include time-current coordination curves plotted on log-log scale graphs.
b) For each graph include (where applicable):
Partial single-line diagram identifying the portion of the system illustrated.
Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
Conductors: Damage curves.
Transformers: Inrush points and damage curves.
Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
Motors: Full load current, starting curves, and damage curves.
Capacitors: Full load current and damage curves.
c) For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
Include ground fault pickup and delay.
Include fuse ratings.

Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.

d) Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4) Arc Flash and Shock Risk Assessment:

a) For the worst case for each scenario, identify at each bus location:
Calculated incident energy and associated working distance.
Calculated arc flash boundary.
Bolted fault current.
Arcing fault current.
Clearing time.
Arc gap distance.

b) For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

c) Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

1.6 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.

1) Study preparer may be employed by manufacturer of electrical distribution equipment.

2) Study preparer may be employed by field testing agency.

3) Study Preparers:

a) Pioneer Power Group: www.pioneerpwr.com/#sle.
b) _____.
c) _____.

B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.

1) Field Supervisor: Certified electrical testing technician; NETA ETT Level III.

C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

1) Products:

a) EasyPower LLC: www.easypower.com/#sle.
b) ETAP/Operation Technology, Inc: www.etap.com/#sle.
c) Power Analytics Corporation: www.poweranalytics.com/#sle.
d) SKM Systems Analysis, Inc: www.skm.com/#sle.
e) _____.
f) Substitutions: See Section 016000 - Product Requirements.

PART 2 PRODUCTS

2.1 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.

1) Materials: Comply with Section 260553.

2) Minimum Size: 4 by 6 inches (100 by 150 mm).

3) Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.

a) Include orange header that reads "WARNING" unless otherwise indicated.
b) Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
c) Include the following information:
Arc flash boundary.
Available incident energy and corresponding working distance.
Site-specific PPE (personnel protective equipment) requirements.
Nominal system voltage.
Restricted approach boundary.
Equipment identification.
Study preparer, report reference, and date calculations were performed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install arc flash warning labels in accordance with Section 260553.

3.2 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Adjust equipment and protective devices for compliance with studies and recommended settings.

E. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.3 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.

1) Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.

2) Provide minimum of eight hours of training.

3) Instructor: Representative of entity performing study.

4) Location: At project site.

3.4 ATTACHMENTS

A. Previous studies.

B. Existing drawings.

END OF SECTION

SECTION 260574
ARC FLASH HAZARD STUDY

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

B. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions,

B. Divisions 0 and 1 and Sections 26 6000 and 26 7000 Specifications apply to work of this section.

1.3 DESCRIPTION

A. Provide an Arc Flash Hazard Study for the electrical distribution system shown on the One Line Diagram. The intent of the Arc Flash Hazard Study is to determine hazards that exist at each major piece of electrical equipment shown on the One Line drawing. This includes switchgear, switchboards, panelboards, motor control centers, PDUs, UPS, ATSs, and transformers. The study shall include creation of Arc Flash Hazard Warning Labels. The labels shall be printed on self-adhesive color nylon or vinyl die cut stock. The electrical contractor shall provide and install the labels.

EXAMPLE OF ARC FLASH WARNING LABEL

A. The Arc Flash Hazard Study shall include the electrical distribution system equipment shown on the One Line Diagram. Use the data from the Fault/Coordination Study from Specification Section 26 0573 to perform the Arc Flash Hazard Study. The Arc Flash Hazard Study shall consider operation during normal conditions alternate operations, emergency power conditions, and any other operations, which could result in maximum arc flash hazard.

2.2 QUALIFICATIONS

A. The Contractor shall have the study prepared by a Registered Professional Electrical Engineer (licensed in the State of California) who has at least ten (10) years of experience in performing power system studies.

B. The arc flash hazard study shall be performed using EasyPower or ETAP for Windows computer software packages.

2.3 SUBMITTALS

A. The contractor shall submit the Arc Flash Hazard Study and arc flash warning labels at least 30 days prior to energizing the electrical equipment.

B. Submit three (3) copies of the power systems study and (1) set of warning labels.

PART 2 EXECUTION

3.1 SHORT CIRCUIT STUDY

A. Perform a Short Circuit Study as specified in Section 26 0573.

3.2 PROTECTIVE DEVICE COORDINATION STUDY

A. Perform a Protective Device Coordination Study as specified in Section 26 0573.

3.3 ARC FLASH HAZARD STUDY

A. Perform an Arc Flash Hazard Study using data from the completed Short Circuit and Protective Device Coordination Studies.

B. Pertinent data, rationale employed, and assumptions in developing the calculations shall be incorporated in the introductory remarks of the study.

C. The study shall be in accordance with applicable NFPA 70E, OSHA 29-CFR, Part 1910 Sub part S and IEEE 1584 Standards.

D. Determine the following

1) Flash Hazard Protection Boundary

2) Limited Approach Boundary

3) Restricted Boundary

4) Prohibited Boundary

5) Incident Energy Level

6) Required Personal Protective Equipment Class

7) Type of Fire Rated Clothing

E. Produce an Arc Flash Warning label listing items 1 – 7 above. Also, include the bus name and voltage. The labels shall be printed on self-adhesive color nylon or vinyl die cut stock.

F. PRODUCE ARC FLASH EVALUATION SUMMARY SHEET LISTING THE FOLLOWING ADDITIONAL ITEMS:

1) Bus Name

2) Upstream Protective Device Name, Type, and Settings

3) Bus Line to Line Voltage

4) Bus Bolted Fault

5) Protective Device Bolted Fault Current

6) Arcing Fault Current

7) Protective Device Trip / Delay Time

8) Breaker Opening Time

9) Solidly Grounded Column

10) Equipment Type

11) Gap

12) Arc Flash Boundary

13) Working Distance

14) Incident Energy

15) Required Protective Fire Rated Clothing Type and Class

PART 3 ANALYSIS

5.1 ANALYZE THE SHORT CIRCUIT AND PROTECTIVE DEVICE COORDINATION, AND ARC FLASH HAZARD CALCULATIONS AND HIGHLIGHT ANY EQUIPMENT, WHICH IS DETERMINED TO BE UNDERRATED OR CAUSES AN ABNORMALLY HIGH INCIDENT ENERGY CALCULATION. PROPOSE APPROACHES TO REDUCE THE ENERGY LEVELS. THE PROPOSED MAJOR CORRECTIVE MODIFICATIONS SHALL BE TAKEN, UNDER THE ADVISEMENT OF THE ENGINEER AND THE CONTRACTOR WILL BE GIVEN FURTHER INSTRUCTIONS.

PART 4 REPORT

6.1 THE RESULTS OF THE POWER SYSTEM STUDY SHALL BE SUMMARIZED IN A FINAL REPORT. THE REPORT SHALL INCLUDE THE FOLLOWING SECTIONS:

1) Introduction, executive summary and recommendations, assumptions and a reduced copy of the One Line Diagram.

2) Arc Flash Evaluations Summary Spreadsheet.

3) Bus Detail Sheets.

4) Arc Flash Hazard Warning Labels printed on self-adhesive color nylon or vinyl die cut stock.

5) CD with system model and database file from the software used in the study.

END OF SECTION

SECTION 260943
DIGITAL-NETWORK LIGHTING CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1) Systems Software Interfaces.

2) System Backbone and System Integration Equipment.

3) Wired Networked Devices.

4) Wireless Networked Devices.

B. Related Requirements:

1) Section 018116 "Facility Environmental Requirements" and Section 018123 "Facility Seismic and Wind Criteria" for seismic-load, wind-load, acoustical, and other field conditions applicable to Work specified in this Section.

2) Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

3) Section 262726 "Wiring Devices" for wired switches and dimmers and other Project requirements applicable to Work specified in this Section.

1.2 DEFINITIONS

A. Data Bus: A wired interface used to communicate with connected devices.

B. Device: A collective term for bus or wireless connected devices, including fluorescent ballasts, LED drivers, incandescent luminaires, manual switches, switching relays, sensors, and similar.

C. Global: Communication between devices in otherwise separate spaces using a bridging device or system controller.

D. Group: A set of devices that communicate together.

E. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

F. Scene: Digital light level associated with a preset.

G. System Backbone: Devices used to connect and manage otherwise separate spaces, including bridging devices and gateways or system controllers. Used to expose devices to software configuration via TCP/IP.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference during initial stages of construction.

B. Preinstallation Coordination Meeting(s): For digital-network lighting controls. Conduct meeting(s) as video conference or at Project site.

1) Attendees: Installers, fabricators, representatives of manufacturers, and administrants for field tests and inspections. Notify Architect, Construction Manager , and Owner's Commissioning Authority of scheduled meeting dates.

2) Engage factory-authorized service representative to attend preinstallation conference and review the submittal drawing, sequence of operation, and device installation best practices with Project team.

3) Engage factory-authorized service representative to perform cellular signal strength measurements during site walk through and compare to Project plans to verify the placement of cellular antennas and quantity of lighting control system RF access points.

1.4 ACTION SUBMITTALS

A. Product Data:

1) Bill of Materials necessary to install the networked lighting control system.

2) Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.

3) Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.

4) Other Diagrams and Operational Descriptions - as needed to indicate system operation or interaction with other system(s).

B. Shop Drawings:

1) Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor Startup/Commissioning Worksheet.

B. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.

C. Field quality-control reports.

D. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Contracts:

1) Hardware and Software Operation Manuals.

2) Maintenance service agreement.

3) Software service agreement.

B. Warranty documentation.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1) Phone Support: Toll-free technical support available from manufacturer through an online tool to schedule a technical support appointment and provide 24/7 emergency support.

2) Remote Support: Manufacturer capable of providing remote support and ability to virtually connect with customers to address issues with visual guidance overlaid on images of real-world objects.

3) Cellular Connectivity: Manufacturer capable of cellular connectivity to a networked lighting control system available to provide remote support within the continental United States.

4) On-Site Support: Manufacturer capable of providing a 72-hour, on-site response time within the continental United States.

5) Service Contracts: Manufacturer capable of providing service contracts for continued on-site and remote support of the lighting control system post-installation for terms up to 10 years from substantial completion, including:

a) Remote and on-site emergency response.
b) Remote system performance checks.
c) Remote diagnostics.
d) Replacement parts.

1.8 WARRANTY

A. Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace, including labor, materials, and equipment, devices that fail to perform as specified within extended warranty period.

1) Failures include, but are not limited to, the following:

a) Faulty operation of lighting control hardware.
b) Faulty operation of lighting control firmware.

2) Minimum Warranty Period: Five years from date of shipment.

3) Extended Warranty Period: ???Insert number??? year(s) from date of shipment.

PART 2 PRODUCTS

2.1 SYSTEM COMPLIANCE

A. System components manufactured in accordance with UL 916 and UL 924 standards where applicable.

B. System components manufactured in accordance with CFR Title 47, Part 15 standards where applicable.

C. System components manufactured in accordance with ISED Canada RSS-247 standards where applicable.

D. System components manufactured in accordance with IFT-008-2015 and NOM-208-SCFI-2016 standards where applicable.

E. System listed as qualified under DesignLights Consortium Networked Lighting Control System Specification v5.0.

F. Performance Criteria:

1) Regulatory Requirements:

a) Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 SYSTEM PERFORMANCE REQUIREMENTS

A. System Architecture:

1) System architecture based upon the following concepts:

a) Networkable intelligent lighting control devices.
b) Standalone lighting control zones using distributed intelligence.
c) Optional system backbone for remote, time-based, and global operation.

2) Intelligent lighting control devices with individually addressable network communication capability and having one or more basic lighting control components including: occupancy sensor, photosensor, relay, dimming output, contact closure input, analog 0-10 V(dc) input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure permissible to minimize overall system device count.

3) System capable of interfacing directly with networked luminaires such that either low-voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches, and system backbone.

4) Networked luminaires and intelligent lighting control devices support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.

5) Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices capable of providing automatic control from sensors (occupancy and/or photosensor) and manual control from local wall stations without requiring connection to a higher-level system backbone.

a) Lighting control zones (wired and wireless) support at least 128 devices per zone.
b) Capable of being networked with a higher-level system backbone to provide time-based control, control from inputs or systems external to control zone, and remote configuration and monitoring through a software interface.

6) Networked luminaires and intelligent lighting control devices with distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones operate according to their defined default settings and sequence of operations.

7) System to include one or more system controllers that provide time-based control.

8) System controller provides means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.

9) System controller supports both low-voltage wired and wireless RF communication within a single controller device.

10) System devices support firmware update, either remotely or from within the application space, for purposes of upgrading functionality at a later date.

11) System capable of reporting lighting system events and performance data to management software for display and analysis.

B. Wired Networked Control Zone Characteristics:

1) Connections to devices within a wired networked lighting control zone and to backbone components accomplished with a single type of low-voltage network cable, compliant with CAT5e specifications or higher. Use of mixed types of low-voltage network cables is unacceptable.

2) Devices connected in "daisy-chain" topology. "Hub-and-spoke" topology, requiring all individual networked devices to be connected to a central component, is unacceptable, to reduce the total amount of network cable required for each control zone.

3) Pre-terminated, plenum-rated, low-voltage network cabling supplied with hardware.

4) Following proper installation and provision of power, all networked devices connected with low-voltage network cable must automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, push button).

a) The "out of box" default sequence of operation is intended to provide typical sequence of operation to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.

5) System software capable of automatic discovery of all connected devices without requiring any provisioning of system or zone addresses.

6) Networked devices capable of detecting improper communication wiring and LED notification to alert installation/startup personnel.

7) Networked control devices suitable for control of egress or emergency light sources without additional, externally mounted UL 924 shunting or 0-10 V(dc) disconnect devices, to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. Capable of supporting the following sequence of operation:

a) Low-Voltage Power Sensing: Devices automatically provide 100 percent light level upon detection of loss of power sensed via low-voltage network cable connection where applicable.

b) Line-Voltage Power Sensing: Devices listed as UL 924 emergency relays that automatically close load-control relay and provide 100 percent light output upon detection of loss of power sensed via line voltage connection to normal power.

8) Global Control Zones: Networked luminaires and intelligent lighting control devices located in different areas able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span multiple areas. Occupancy, photosensor inhibit, and switch commands available across multiple controllers.

9) Wired Networked Wall Station Scene-Control Capabilities:

a) Preset Scenes that activate a specific combination of light levels across multiple local and global channels.

b) Local Profile Support: Profile Scenes that modify the sequence of operation for devices in the area (group) in response to a button press to dynamically optimize occupant experience and lighting energy usage.

Wall stations able to manually start and stop local profiles, or local profile capable of ending after a specific duration of time between five minutes and 12 hours.

Configurable Parameters:

(a) Fixture light level.
(b) Occupancy time delay.
(c) Response to occupancy sensors (including enabling/disabling response).
(d) Response to daylight sensors (including enabling/disabling response).
(e) Enabling/disabling wall stations.

c) Three-Way or Multi-Way Control: Multiple wall stations capable of controlling the same local and global control zones, to support "multi-way" preset scene and profile scene control.

C. System Integration Capabilities:

1) Capable of interface with third-party building management systems (BMS) to support two-way communication using BACnet/IP protocol, BACnet MS/TP protocol, and RESTful API including the following system integration capabilities:

a) "Write" messages for control of individual devices, including control of relay and dimming output.
b) "Write" messages for control of groups of devices through a single command, including control of relay and dimming output of all devices.
c) "Read" messages for individual device status information.

Available status will vary based on device type and capabilities, which may include relay state, dimming output, power measurement, occupancy sensor status, and photosensor light measurement.

d) "Read" messages for group status information for occupancy, relay state, and dimming output.
e) Activation of pre-defined system Global Profiles.

2) Activation of Global Profiles from third-party systems via dry contact closure output signals or digital commands via RS-232 or RS-485.

3) Activation of demand response levels from Demand Response Automation Servers (DRAS) via OpenADR 2.0a protocol.

D. Supported Sequence of Operations:

1) Control Zones:

a) Local Control Zones: Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) capable of transmitting and tracking occupancy sensor, photosensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within area. These will also be referred to as local control zones.
b) Adjacent Control Zones: Networked luminaires and intelligent lighting control devices capable of tracking occupancy broadcasts from adjacent zones. When this feature is enabled, luminaire output for a vacant zone will reduce to a configurable dimmed state if one or more adjacent zones are occupied. Luminaires will turn off when both primary and adjacent zones are vacant.

c) Global Control Zones: Networked luminaires and intelligent lighting control devices located in different areas able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span across multiple areas. Occupancy, photosensor inhibit, and switch commands available across multiple controllers.

2) Wall Station Capabilities:

a) Wall stations support the following capabilities:
On/Off of a local or global control zone.
Continuous dimming control of light level of a local or global control zone.

b) Multi-Way Control: Multiple wall stations capable of controlling the same local or global control zones, to support "multi-way" switching and dimming control.

3) Occupancy Sensing Capabilities:

a) Occupancy sensors configurable to control a local or global zone.

b) Multiple occupancy sensors capable of controlling the same local or global zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.

c) Occupancy sensing sequence of operation modes:
On/Off Occupancy Sensing.
Partial-On Occupancy Sensing.
Partial-Off Occupancy Sensing.
Vacancy Sensing (Manual-On/Automatic-Off).

d) On/Off, Partial-On, and Partial-Off Occupancy Sensing Modes Sequence of Operation:
Occupancy automatically turn lights on to a designated level when occupancy is detected. Designated occupied light level support at least 100 dimming levels.
Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.
System capable of combining Partial-Off and Full-Off operation by dimming lights to a designated level when vacant and turning the lights off completely after an additional time delay.
Photosensor readings, if enabled in occupancy sensing control zone, automatically adjust light levels during occupied or unoccupied conditions as necessary.
Wall station activation changes the dimming level or turn lights off as selected by the occupant. Lights optionally remain in this manually specified light level until the zone becomes vacant. Upon vacancy, normal sequence of operation resumes.

e) Vacancy Sensing or Manual-On/Automatic-Off Mode Sequence of Operation:
Activation of a wall station is required to turn lights on. System capable of programming the zone to turn on to either a designated light level or previous user-set light level. Initially occupying the space without using a wall station must not result in lights turning on.
Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.
System capable of dimming the lights when vacant and then turning the lights off completely after an additional time delay.
System capable of an "automatic grace period" immediately following detection of vacancy, during which time any detected occupancy results in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.

Photosensor readings, if enabled in the Occupancy Sensing control zone, capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary.

Wall station interaction changes the dimming level or turns lights off as selected by occupant. Lights remain at manually specified light level until zone becomes vacant; normal sequence of operation resumes upon vacancy.

f) Occupancy time delays before dimming or shutting off lights separately programmable for all control zones from 15 seconds to 2 hours.

4) Photosensor Sensing Capabilities (Automatic Daylight Sensing):

a) Photosensor devices configurable to control a local zone.

b) Photosensor-Based Control:

Continuous Dimming: Control zone automatically adjusts dimming output in response to photosenor readings, to maintain a minimum light level consisting of both electric light and daylight sources. Photosensor response configurable to adjust set point and dimming rates.

5) Schedule Capabilities:

a) System capable of time schedules for time-of-day to override devices including offsets from dusk and dawn.

b) System capable of providing a visible "blink warning" five minutes prior to the end of the schedule.

c) Wall stations may be programmed to provide timed extensions/overrides that turn the lights on for an additional time period.

Timed override/extension duration programmable for each individual device, zone of devices, or customized group of devices, from five minutes to 12 hours.

6) Global Profile Capabilities:

a) System capable of automatically modifying the sequence of operation for selected devices in response to any of the following:

Time-of-day schedule.

Contact closure input state.

Manually triggered wired wall station input.

RS-232/RS-485 command to wired input device.

BACnet input command.

b) Global Profile Capabilities:

Global Profiles stored within and executed from the system controller (via internal timeclock). Dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.

Global Profile time-of-day schedules capable of recurrence settings including daily, specific days of week, every "n" number of days, weekly, monthly, and yearly. Lighting control global profile schedules support definition of start date, end date, end after "n" recurrences, or never ending.

Daylight savings time adjustments capable of being performed automatically, if desired.

Global Profile holiday schedules follow recurrent settings for specific U.S. holiday dates regardless if they always occur on a specific date or are determined by day/week of the month.

Global Profiles capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times automatically derived from location information using an astronomical clock.

Software management interface capable of displaying a graphic calendar view of profile schedules for each control zone.

Global Profiles capable of manual activation directly from system controller, specially programmed wired input devices, scene-capable wired wall stations, and software management interface.

Global Profiles selectable to apply to a single device, zone of devices, or customized group of devices.

Global Profile Configurable Parameters:

(a) Fixture light level.
(b) Occupancy time delay.
(c) Response to occupancy sensors (including enabling/disabling response).
(d) Response to daylight sensors (including enabling/disabling response).
(e) Enabling/disabling of wall stations.

c) Local and Global Profiles backed up and stored on software's host server such that Profile backup can be applied to a replacement system controller or wired wall station.

7) System supports automated demand response capabilities with automatic reduction of light level to at least three levels of demand response, configurable for each output device.

2.3 SYSTEMS SOFTWARE INTERFACES

A. Management Interface:

1) Web-based management interface for remote system control, live status monitoring, and configuration of lighting control settings and schedules.

2) Compatible with industry-standard web browser clients.

3) Minimum of 100 unique password-protected user accounts.

4) Minimum of three user permission levels: read-only, read and change settings, and full administrative system access.

5) Capable of restricting access for user accounts to specific devices within the system.

6) All system devices capable of being given user-defined names.

7) Device identification information displayed in the Management interface including:

a) Model number.
b) Model description.
c) Serial number or network ID.
d) Manufacturing date code.
e) Custom label.
f) Parent network device.

8) Management interface capable of displaying live status of a networked luminaire or intelligent control device including:

a) Luminaire on/off status.
b) Dim level.
c) Power consumption.
d) Device temperature.
e) PIR occupancy sensor status.
f) Microphonic occupancy sensor status.
g) Remaining occupancy time delay.
h) Photosensor reading.

i) Active Profiles.

9) Management interface capable of displaying and modifying the current active settings of a networked luminaire or intelligent control device including:

a) Dimming trim levels.
b) Occupancy sensor and photosensor enable/disable.
c) Occupancy sensor time delay and light level settings.
d) Occupancy sensor response (normal or vacancy).
e) Photosensor setpoints and transition time delays.

10) Management interface capable of applying settings changes for a zone of devices or a group of selected devices using a single action that does not require the user to apply settings changes for each individual device.

11) Management interface capable of compiling a printable network inventory report.

12) Management interface capable of compiling a printable report detailing all system profiles.

13) All sensitive information stored encrypted.

14) System software updates available for automatic download and installation via the Internet.

B. System Energy Analysis and Reporting:

1) Intuitive graphical screens to facilitate simple viewing of system energy performance.

2) Energy Scorecard: Summarized display that indicates calculated energy savings in dollars or KWh.

3) Software calculates allocation of energy savings by control measures including occupancy sensors, photosensors, and manual switching.

4) Energy savings data calculated for the system as a whole.

5) Time-scaled graph showing all relay transitions.

6) Time-scaled graph showing zone occupancy time delays.

7) Time-scaled graph showing the total light level.

8) Software capable of storing information remotely onto an open-source, object-relational database, such as PostgreSQL.

9) Data stored in the database will be accessed utilizing an open standard, application programming interface, such as Open Database Connectivity (ODBC).

C. Visualization and Programming Interfaces:

1) System provides an optional web-based visualization interface that displays a graphical floorplan.

2) Graphical floorplan will offer the following types of system visualization:

a) Full Device Option: Master graphic of entire building, by floor, showing each control device installed with zones outlined including:
Controls embedded light fixtures.
Controls devices not embedded in light fixtures.
Daylight sensors.

Occupancy sensors.
Wall switches and dimmers.
Scene controllers.
Networked relays.
Wired bridges.
System controllers.
Wired relay panels.
Group outlines.

b) Group-Only Option: Master graphic of the entire building, by floor, showing only control groups outlined.
c) Pan and zoom commands supported to allow smaller areas to be displayed on a larger scale simply by panning and zooming each floor's master graphic.
d) Selecting any control device displays the following as applicable:
Device catalog number.
Device name and custom label.
Device diagnostic information.
Link to further information on device including status or current configuration.

3) Programming capabilities through the application will include the following:

a) Switch, occupancy sensor, and photosensor zone configuration.
b) Manual-on or automatic-on modes.
c) Turn-on and dim to dimming levels.
d) Occupancy sensor time delays and PIR sensitivity.
e) Dual technology occupancy sensors sensitivity.
f) Photosensor calibration adjustment and auto-setpoint.
g) Multiple photosensor zone offset.
h) Trim level settings.
i) Preset scene creation and copy for scene-capable devices.
j) Application of custom device labels to the Bluetooth Low-Energy Programming Devices and individual connected lighting control devices.
k) Fade rate settings.

D. Smartphone Programming Interface for Wired and Wireless Devices:

1) Interface provided for both Apple iOS and Android operating systems that allows configuration of lighting control settings.

2) Application supports configuration of wireless networked control devices.

a) Application access granted with valid user name and password.
b) Access to program information governed by permission system that allows users to share access with other users and restrict access to those who should not be able to reconfigure the equipment.
c) Indication of signal strength where multiple Bluetooth Low-Energy Programming Devices are available for configuration.

3) Application supports configuration or wired networked control devices.

a) Connected device access granted through user-defined passcode at initial install.
b) Indication of signal strength where multiple Bluetooth Low-Energy Programming Devices are available for configuration.

4) Programming Capabilities:

a) Switch, occupancy sensor, and photosensor group configuration.
b) Manual-on or automatic-on modes.
c) Turn-on and dim to dimming levels.
d) Occupancy sensor time delays and PIR sensitivity.
e) Dual technology occupancy sensors sensitivity.
f) Photosensor calibration adjustment and auto-setpoint.
g) Multiple photosensor zone offset.
h) Trim level settings.
i) Preset scene creation.
j) Application of custom device labels for individual connected lighting control devices.
k) Fade rate settings.

E. Lighting Control Installation Software (Visual Installer):

1) Interface provided for both Apple iOS and Android operating systems that allows configuration of lighting control settings.

2) Application supports entry and display of lighting control information.

a) Displays product locations and rooms graphically using a lighting control floor plan.
b) Product locations are interactive:
Selecting a device displays product nomenclature.
Devices can be moved across floor plan background.
User can assign unique device IDs to devices by the following options:
(a) Manual entry of device IDs.
(b) Bluetooth identification.
(c) Scan unique device barcode or QR code.
Devices can be marked as "skipped" to indicate that installation did not take place.
Text and image notes can be added to product locations.
c) Displays installation status as a percentage. Installation status updates as devices are marked as installed or assigned unique device IDs.

3) Project data is stored in manufacturer portal.

4) Includes appropriate security provisions:

a) Role-based access controls.
b) User-based access controls.
c) Two-factor authentication.
d) Modern transport layer protocols.
e) AES-128 bit encryption for data at rest.

2.4 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

A. System Controller: Multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nECY or comparable product by one of the following:

a) Cooper Industries, Inc.
b) Leviton Manufacturing Co., Inc.

2) System Controller Processor: 32-bit microprocessor operating at a minimum of 1 GHz.

3) System Controller Memory: Minimum of 512MB memory, with a minimum of 4GB non-volatile flash, to support operating system and databases.

4) System Controller Functions:

   a) Time-based control of downstream wired and wireless network devices.
   b) Linking into an Ethernet network.
   c) Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
   d) Connection to various software interfaces, including management interface, historical database and analytics interface, and visualization interface.

5) Integral web server to support system controller configuration and diagnostics with control and visualization of connected devices.

   a) Web Server Control Interface:
      Display associated devices within the context of a graphical floorplan.
      Provide control of output-capable devices through virtual sliders, toggle buttons, preset level widgets, and transparent layers on floorplan.
      Control Capabilities:
   (a) Control of individual output devices, including control of relay state and analog dimming level where applicable.
   (b) Control of local lighting control zones, including control of relay state and analog dimming level where applicable.
   (c) Control of global lighting control zones, including control of relay state and analog dimming level where applicable.
   (d) Control of Global Profiles.
   b) Visualization Interface:
      Customizable display with the ability to superimpose colored, transparent layers representing real-time property values, including occupancy status, dimming level status, light level status, and online or offline status where applicable.
      Ad hoc display of trended information via an intuitive values-over-time graph.
      Report Creation:
   (a) Reports accept and graphically display trended status datasets for creator selected devices or zones of devices.
   (b) Report information displayed over a user-defined interval and date range.
   (c) Reports exportable to a standard CSV format.

6) Graphical touch screen to support configuration and diagnostics.

7) Minimum of three RJ-45 networked lighting control ports for connection to any of the following:

   a) Graphical touch screen.
   b) Wired communication bridges.
   c) Direct connection to networked wired luminaires and intelligent lighting control devices (up to 128 total devices per port).

8) Device will automatically detect all network-connected devices.

9) Capable of managing and operating a minimum of 750 networked devices (wired or wireless) per system controller.

10) Multiple System Controllers capable of connection via LAN for scalability to a minimum of 20,000 networked devices.

11) Supports BACnet/IP and BACnet MS/TP protocols to directly interface with BMS and HVAC equipment without additional protocol translation gateways.

    a) BACnet MS/TP Connection Speed: 9600 to 115200 baud rate.
    b) BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.

12) Integral FIPS 140-2, Level 1 cryptographic module.

13) Supports RESTful API for control of BACnet objects, user management, date and time, and file management.

14) NEMA 1 enclosure with Class 1 and Class 2 separation.

    a) Power Supply Voltage: 120 to 277 V(ac).

15) Automatic algorithm to eliminate redundant, wireless networked paths to streamline communication between the system controller and end devices.

16) System Controller Security Provisions:

    a) Disallow the use of default passwords and require passwords to be updated prior to use.
    b) Support user role-based access, such as administrator, user, and viewer.
    c) Signed firmware to ensure that unmodified, authentic software is always installed.
    d) IP-based communication protected with strong encryption algorithms such as AES or TLS1.2+.
    e) Prevent rollback of firmware to firmware versions with known, critical vulnerabilities.
    f) Valid cybersecurity listing through a third party.

17) Cellular Remote Access: Cellular router and modem for remote access.

    a) Router supports remote access to at least five system controllers on its local area network or network subnet.
    b) Remote access capable of device setting updates, schedule updates, system performance optimization, and diagnostics.
    c) Remote access enabled through outbound communication from router to an outside source. Solutions that begin communication via inbound requests for network access are unacceptable.
    d) Router supports outbound communication to manufacturer-hosted portal using TLS1.2 or greater in-transit encryption over a cellular or Ethernet connection.
    e) Router with integral firewall to prevent unauthorized access to devices connected to its local area network port.
    f) Router includes cellular SIM capable of connection to AT&T, T-Mobile, Sprint, US Cellular, Alaska Wireless, Telefonica, Tellus, Bell, or Sasktel networks where carrier service is available.
    g) Outbound communication from the router limited to whitelisted endpoints. Devices that allow unrestricted communication are unacceptable.
    h) Outbound communication from router includes only lighting control system information.

2.5 WIRED NETWORKED DEVICES

A. Wired Networked Wall Switches, Dimmers, Scene Controllers:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPODM, nPODM xS, nPODM xL, or comparable product by one of the following:

    a) Cooper Industries, Inc.

b) Leviton Manufacturing Co., Inc.

2) Mounting: Suitable for installation in single-gang switch box.

3) Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.

4) All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.

5) Devices with mechanical push buttons provide tactile and LED user feedback.

6) Devices with mechanical push buttons manufactured with custom button labeling.

7) Wall switch and dimmer options:

a) Number of Control Zones: Per requirements on drawing documents.
b) Control Types Supported:
On/Off.
On/Off/Dimming.
On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types.
c) Color: White.

8) Scene Controller Options:

a) Number of Scenes: Four
b) Control Types Supported:
On/Off.
On/Off/Dimming.
Preset Level Scene Type.
On/Off/Dimming/Preset Level for Correlated Color Temperature.
Reprogramming of other devices within daisy-chained zone to implement user-selected lighting scene including manual start/stop from the scene controller, or optionally programmed automatic stop after a user-selectable duration between five minutes and 12 hours.
Selecting a lighting profile to be run by device's upstream controller to implement a selected lighting profile across multiple zones including manual start/stop from the scene controller, or optionally programmed automatic stop after a user selectable duration between five minutes and 12 hours.
c) Color: White

B. Networked Graphic Wall Stations:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPOD TOUCH or comparable product by one of the following:

a) Cooper Industries, Inc.
b) Leviton Manufacturing Co., Inc.

2) Mounting: Suitable for installation in single-gang switch box.

3) Integral 3.5-inch (88 mm) capacitive full-color touch screen.

4) Power via polarity insensitive Class 2 low-voltage 15 to 24V (dc) power supply.

5) Device enables mobile application control of control zones and scenes through Bluetooth.

6) Communication over standard low-voltage network cabling with RJ-45 connectors.

7) User-customizable screen saver utilizing uploaded image file in common file format including jpg, png, gif, bmp, or tif.

8) Capable of configuration of all switches, dimmers, control zones, and lighting preset scenes via password-protected setup screens.

9) Graphic Wall Station Options:

a) Number of Control Zones: Up to 16.
b) Number of Scenes: Up to 16.
c) Profile Scene Duration: User configurable from five minutes to 12 hours.
d) Color: White

C. Digital Time Clock:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nDTC or comparable product by one of the following:

a) Cooper Industries, Inc.
b) Leviton Manufacturing Co., Inc.

2) Controls a linear bus of lighting devices supplying all time functions without connection to a system controller.

a) Programming of the linear bus of lighting devices must not require additional hardware, including computers, specialized dongles, or other connection devices.
b) Programming of the linear bus exclusively done through the touch-screen interface.

3) Capable of up to 32 schedules. Each schedule consists of one set of On and Off times per day for each day of the week and for each of two holiday lists. Schedules assignable to any individual relay or group of relays.

4) Operates from non-volatile memory so that all system programming is retained indefinitely.

5) Mounted inside a relay panel to eliminate the necessity for additional enclosures for complete installation.

6) Capacitive 3.5-inch (88 mm), full-color touch screen.

D. Wired Networked Digital Key Switches:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPODA KEY MNTN or comparable product by one of the following:

a) Cooper Industries, Inc.
b) Leviton Manufacturing Co., Inc.

2) Mounting: Suitable for installation in single-gang switch box.

3) Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.

4) All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.

5) LED user feedback to provide indication of on/off status of the programmed lights or scene, as well as indication of device power.

6) Digital Key Switch Options:

a) Control Types Supported:
On/Off.
On/Off/Dimming.
Preset Level Scene Type.
On/Off/Dimming/Preset Level for Correlated Color Temperature.
User-programmed local lighting scene run within a daisy-chained group including manual start/stop from the switch, or optionally programmed automatic-stop after a user-selectable duration between five minutes and 12 hours.
User-programmed global lighting profile run by an upstream controller across multiple groups including manual start/stop from the switch, or optionally programmed automatic-stop after a user-selectable duration between five minutes and 12 hours.
b) Color: White.

E. Wired Networked Auxiliary Input / Output (I/O) Devices:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nIO series or comparable product by one of the following:

a) Cooper Industries, Inc.
b) Leviton Manufacturing Co., Inc.

2) Plenum rated.

3) Mounting: Inline wired, Extended chase nipple for mounting to a 1/2-inch (16 mm) knockout.

4) Communication and low-voltage power delivered to each device via standard low-voltage network cabling with RJ-45 connectors.

5) Auxiliary Input/Output Devices Options:

a) Contact closure or pull-high input.
Input programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, activate lights at a preconfigured level, ramp light level up or down, or toggle lights on/off.
b) 0-10 V analog input.
Input supports zero to 10 V dimming output control from a dimmer switch.
Input programmable to function as a daylight sensor.
c) RS-232/RS-485 digital input.
Input supports activation of up to four local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
Provides relay and dimming level status to external device (e.g. Touchscreen) when polled.
d) 0-10 V dimming control output, capable of sinking up to 20mA.
Output programmable to support all standard sequence of operations supported by system.
e) Digital control output via eldoLED LEDcode communication.
Output programmable to support light intensity control, as well as optional correlated color temperature (CCT) control, of the connected luminaire.

F. Wired Networked Occupancy and Photosensors:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nCM, nCMB, or comparable product by one of the following:

a) Cooper Industries, Inc.

b) Leviton Manufacturing Co., Inc.

2) Detect the presence of human activity within space and fully control the on/off function of lights.

3) Utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic and Microwave-based sensing technologies are unacceptable.

4) Dual technology sensors used in locations where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions).

5) Dual technology sensors must have one sensing technology not motion dependent to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT), which detects both occupant motion and sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) are unacceptable.

6) All sensing technologies are acoustically passive, meaning they do not transmit sound waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers and hearing devices). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonic technology. Ultrasonic and Microwave-based sensing technologies are unacceptable.

7) Ceiling, fixture, recessed, and corner mounted sensors available, with multiple lens options available customized for specific applications.

8) Communication and low-voltage power delivered to each device via standard low-voltage network cabling with RJ-45 connectors.

9) All sensors detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.

10) Sensor programming parameter available and configurable remotely from the software and locally via the device push button.

11) Ceiling mount occupancy sensors include one integrated dry contact switching relay, capable of switching 1 A at 24 V, resistive only.

12) Sensors available with one or two occupancy "poles," each of which provides a programmable time delay.

13) Photosensor/daylight override, automatic dimming control, and low temperature/high humidity operation.

14) Photosensor provides one on/off set-point and includes a dead band to prevent the artificial light from cycling. Delay incorporated into the photosensor to prevent rapid response to passing clouds.

15) Photosensor and dimming sensor's set-point and dead band automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-Point Programming" procedure. Min and max dim settings as well as set-point may be manually entered or modified.

16) Dead band setting verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

17) Dual zone option available for On/Off Photosensor, Automatic Dimming Control Photosensor, or Combination units. Secondary daylight zone capable of being controlled as an "offset" from primary zone.

G. Wired Networked Wall Switch Sensors:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nWSX LV, nWSXA LV or comparable product by one of the following:

a) Cooper Industries, Inc.
b) Leviton Manufacturing Co., Inc.

2) Mounting: Suitable for installation in single-gang switch box.

3) Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.

4) All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.

5) Devices with mechanical push buttons provide tactile and LED user feedback.

6) Wall Switch Sensor Options:

a) User Input Control Types: On/Off/Dimming.
b) Occupancy Sensing Technology: Dual technology acoustic.
c) Daylight Sensing Option: Inhibit Photosensor.
d) Color: White.

H. Wired Networked Embedded Fixture Sensors:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nES or comparable product by one of the following:

a) Cooper Industries, Inc.
b) Leviton Manufacturing Co., Inc.

2) Network system sensors with occupancy sensors and/or dimming photosensors that can be embedded into luminaire such that only the lens shows on luminaire face.

3) Occupancy sensor detection pattern suitable for 7.5- to 20-ft. (2.2- to 6-m) mounting heights.

4) Embedded Sensor Options:

a) Occupancy Sensing technology: PIR only.
b) Sensing Option: Combination Occupancy/Daylight sensor.

I. Wired Networked Power Packs:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nPP16 series or comparable product by one of the following:

a) Cooper Industries, Inc.
b) Leviton Manufacturing Co., Inc.

2) Plenum rated.

3) Communication will be delivered to each device via standard low-voltage network cabling with RJ-45 connectors.

4) Supply Voltage: 120 to 277 V(ac).

5) Relay Output: Class 1 relay rated for 16 A at 277 V(ac) and 1/2 HP at 120 V(ac).

6) Dimming Output: 0-10 V(dc) dimming output.

7) Sink Current: 100 mA at 0-10 V(dc).

8) Mounting: Integral 1/2-inch (16-mm) chase nipple. Plastic clips into junction box are unacceptable.

J. Wired Networked Relay and Dimming Panel:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; ARP or comparable product by one of the following:

a) Cooper Industries, Inc.
b) Leviton Manufacturing Co., Inc.

2) Outputs: 16 Individual relays per panel, with an equal number of individual 0-10 V(dc) dimming outputs.

3) Field Configurable Relays (FCR):

a) Field configurable to operate in single-, double-, or triple-pole relay groupings.
b) Field configurable to operate as normally closed or normally open.
c) Provides visual status of current state and manual override control of each relay.
d) Minimum Relay Contact Ratings:
40 A at 120-480 V(ac) Ballast.
16 A at 120-277 V(ac) Electronic.
20 A at 120-277 V(ac) Tungsten.
20 A at 48V (dc) Resistive.
2 HP at 120 V(ac).
3 HP at 240-277 V(ac).
65kA SCCR at 480 V(ac).

4) Dimming Output Rating: Minimum of 100 mA sink current per dimming output.

5) Relay and dimming outputs individually programmable.

6) Listing: UL 924 for control of emergency lighting circuits.

7) Power Supply: Integrated 120-277 V(ac) supply.

8) Low-Voltage Sensor Input:

a) Configurable to support any of the following input types:
Indoor Photosensor.
Outdoor Photosensor.
Occupancy Sensor.
Contact Closure.
b) Low-voltage sensor input provides 24 V(dc) power for sensor so additional auxiliary power supplies are not required.
c) Sensor input supports all standard sequence of operations.

9) Integrated Digital Time Clock for local schedule control.

10) Contact Closure Input: One for each group of eight output relays that acts as a panel override to activate the normally configured state of all associated relays (i.e., normally open or normally closed).

11) Panel supplies current limited low-voltage power to other networked devices connected via low-voltage network cable.

12) Enclosure:

a) Enclosure Rating: NEMA 1.
b) Mounting: Surfacemounted.
c) Cover: Hinged cover with keyed lock.

K. Wired Networked Bluetooth Low-Energy Programming Device:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nIO BT or comparable product by one of the following:

a) Cooper Industries, Inc.
b) Leviton Manufacturing Co., Inc.

2) Plenum rated, inline wired, and screw mountable.

3) Communication and low-voltage power delivered to device via standard low-voltage network cabling with RJ-45 connectors.

4) Bluetooth communication allows connection from smartphone application for programming device settings within the local daisy-chain zone.

5) Device provides visual indication of remote Bluetooth connection via LED integrated into device enclosure such that it is visible from all angles while the zone is being programmed.

L. Wired Networked Communication Bridge:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nBRG or comparable product by one of the following:

a) Cooper Industries, Inc.
b) Leviton Manufacturing Co., Inc.

2) Suitable for surface mount to a standard 4 by 4-inch (100 by 100 mm) square junction box.

3) Communication Ports: Eight RJ-45 ports for connection to lighting control zones (up to 128 devices per port), additional network bridges, and System Controller.

4) Capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to System Controller.

5) Power Input: Class 2 low-voltage supplied locally via a directly wired power supply.

6) Wired Bridge capable of redistributing power from its local supply and connected lighting control zones with excess power to lighting control zones with insufficient local power. Architecture enables loss of power to a particular area to be less impactful on network lighting control system.

2.6 WIRELESS NETWORKED DEVICES

A. Wireless Networked Embedded Fixture Control Devices:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; rIO or comparable product by one of the following:

    a) Cooper Industries, Inc.
    b) Leviton Manufacturing Co., Inc.
2) Wireless Communication:

    a) Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.
    b) Security: AES-128 bit.
3) Power Supply: Standard low-voltage wiring typically associated with an LED driver.

4) Suitable for installation within a luminaire such that the control device is not visible on the luminaire face.

5) Devices available with integrated and remote antennas such that devices can be installed within sealed container without detriment to wireless strength.

6) Antenna Color: White

7) Dimming Output: 0-10 V.

8) Power loss detection, where unit powers and controls the emergency circuit. Loss of wireless broadcasts from a dedicated normal-power-connected device forces unit to shunt closed, go to full bright, and ignore all system commands until main power is restored.

B. Wireless Networked Outdoor Occupancy and Photosensors:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.;[rSDGR, rSBOR, rTLN or comparable product by one of the following:

    a) Cooper Industries, Inc.
    b) Leviton Manufacturing Co., Inc.
2) Wireless Communication:

    a) Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.
    b) Security: AES-128 bit.
3) Mounting: In-fixture mount with IP65 rating.

4) Supply Voltage: 120 to 277 V(ac).

5) Detect the presence of human activity within space and fully control the on/off function of lights.

6) Utilizes passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic and Microwave-based sensing technologies are unacceptable.

7) Sensors detect valid communication and blink a unique LED pattern to visually indicate a potential issue.

8) Sensor programming parameters available and configurable remotely.

9) Available with multiple lens options available for various mounting heights.

10) Power Monitoring: Integral current measurements on output with 3 percent accuracy when measuring loads 225 mA or greater.

11) Integral daylight photosensor for programmable daylight harvesting.

12) Photosensor includes adjustable illumination set-point and dead band to prevent the artificial light from cycling. Set-point and dead band capable of automatically calibrating through an "Automatic Set-Point Programming" procedure. Min and max dimming settings and set-point may be manually entered or modified.

13) Dead band setting verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

14) Power loss detection, where unit powers and controls the emergency circuit. Loss of wireless broadcasts from a dedicated normal-power-connected device forces unit to shunt closed, go to full bright, and ignore all system commands until main power is restored.

C. Wireless Networked Outdoor Embedded Sensors:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; rMSOD, rSBG, or comparable product by one of the following:

a) Cooper Industries, Inc.
b) Leviton Manufacturing Co., Inc.

2) Wireless Communication:

a) Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.
b) Security: AES-128 bit.

3) Sensors consisting of occupancy sensors and dimming photosensor suitable for installation within a luminaire such that only the lens is visible on luminaire face.

4) Power Supply: Standard low-voltage wiring typically associated with an LED driver.

5) Color: White.

6) Ingress Protection: Minimum IP66.

7) Devices available with remote antennas such that devices can be installed within sealed container without detriment to wireless strength.

8) Detect the presence of human activity within space and fully control the on/off function of lights.

9) Utilizes passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic and Microwave-based sensing technologies are unacceptable.

10) Sensors detect valid communication and blink a unique LED pattern to visually indicate a potential issue.

11) Sensor programming parameters available and configurable remotely.

12) Available with multiple lens options available for various mounting heights.

13) Integral daylight photosensor for programmable daylight harvesting.

14) Photosensor includes adjustable illumination set-point and dead band to prevent artificial light from cycling. Set-point and dead band capable of automatically calibrating through an

"Automatic Set-Point Programming" procedure. Min and max dimming settings and set-point may be manually entered or modified.

15) Dead band setting verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

16) Power loss detection, where unit powers and controls the emergency circuit. Loss of wireless broadcasts from a dedicated normal-power-connected device forces unit to shunt closed, go to full bright, and ignore all system commands until main power is restored.

D. Wireless Networked Communication Adapter:

1) Basis-of-Design Product: Subject to compliance with requirements, provide nLight; Acuity Brands Lighting, Inc.; nECYD or comparable product by one of the following:

a) Cooper Industries, Inc.
b) Leviton Manufacturing Co., Inc.

2) Wireless Communication:

a) Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.
b) Security: AES-128 bit.

3) Capable of supporting a minimum of 750 networked wireless devices per adapter.

4) Interface: USB connection.

5) Ingress Protection: Minimum IP66.

6) Mounting: Integral 1/2-inch (16-mm) chase nipple. Minimum 16 feet (487.68 cm) USB cable and optional cable extenders for remote mounting.

PART 3 EXECUTION

3.1 INSTALLATION OF WIRING

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260523 "Control-Voltage Electrical Power Cables." Minimum conduit size is 1/2 inch (12.7 mm).

1) Comply with requirements for cable trays specified in Section 260536 "Cable Trays for Electrical Systems."

2) Comply with requirements for raceways and boxes specified in Section 260533.13 "Conduits for Electrical Systems" and Section 260533.16 "Boxes and Covers for Electrical Systems."

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 IDENTIFICATION

A. Identify system components, wiring, cabling, boxes, cabinets, and terminals. Comply with identification requirements specified in Section 260553 "Identification for Electrical Systems."

B. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with Section 260553 "Identification for Electrical Systems."

C. Identify all controls with device address by at least one of the following:

1) Peel removable unique device address labels from lighting control products and place labels onto printed electrical set.

2) Peel removable unique device address labels from lighting control products and place labels onto one-line riser diagram.

3) Peel removable unique device address labels from lighting control products and place labels onto manufacturer label template.

4) Capture unique device address label information using manufacturer-provided mobile application.

D. Label each device cable within 6 inch (152.4 mm) of connection to bus power supply or termination block.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1) Test continuity of each circuit.

B. Field tests and inspections must be witnessed by authorities having jurisdiction.

C. Tests and Inspections: Engage a factory-authorized service representative to perform test inspections.

1) Test each zone using local and remote control hardware.

2) Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.

D. Nonconforming Work:

1) Lighting controls will be considered defective if they do not pass tests and inspections.

2) Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

E. Field Test Reports: Engage a factory-authorized service representative to prepare field test reports.

1) Prepare functionality and inspection reports, including a certified report that identifies controls included and describes test results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

2) Include list of all points created from actual tests of all addressed control points for lamps, ballasts, manual controls, and sensors.

3.4 REMOTE ACCESS

A. Digital network lighting control system capable of remote access by manufacturer with the following features:

1) System diagnostics including detection of fault condition in hardware or connected devices.

2) Access to all connected devices for complete programming including scheduling of time-of-day events and device parameters necessary to meet required sequence of operations.

3) Browser-based interface to verify system functionality.

4) On-demand access to manufacturer technical support for remote troubleshooting, diagnostics, configuration, and programming.

5) Owner training on the digital network lighting control system available remotely.

B. Remote access system fully functional over commercial celluar connection or Internet-connected ethernet network.

C. All hardware associated with remote access including cellular modem and cellular antenna are to remain on-site regardless of warranty or cellular contract status.

3.5 SYSTEM STARTUP

A. Engage a factory-authorized service representative to perform startup service.

1) Complete installation and startup checks in accordance with manufacturer's published instructions.

2) Activate luminaires and verify that all maximum output levels match output levels detailed in an Owner-approved sequence of operations.

3) Confirm correct communications wiring, initiate communications between control devices and controller/gateways, and program the lighting control system in accordance with approved configuration schedules, time-of-day schedules, and input override assignments.

4) Program network devices to meet required sequence of operations.

5) Program and verify all sequence of operations.

6) Create backup of system programming.

7) Assist in installation of system software on customer-provided workstation or server.

8) Verify bidirectional communication of manufacturer-provided cellular router with manufacturer-managed remote access portal.

B. Commissioning Walkthrough: Engage factory-authorized service representative to collaborate with third-party commissioning agent to demonstrate lighting control system functionality and verify the system meets the specified Project requirements.

3.6 CLOSEOUT ACTIVITIES

A. Enhanced Documentation: Engage lighting system manufacturer to provide comprehensive system documentation including detailed programming, sequence of operation data per Project specifications, and related code requirements.

B. Training: Engage lighting system manufacturer to provide comprehensive system overview, software overview, and documentation relating to system operation and maintenance.

3.7 PROTECTION

A. After installation, protect digital network lighting controls from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.8 MAINTENANCE

A. Engage a factory-authorized service representative to perform on-site system adjustments.

1) On-Site Occupancy Adjustments: When requested within 2 months from date of Substantial Completion, provide on-site settings adjustments to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

2) Prepare and submit report after each visit that details activities performed.

B. Engage a factory-authorized service representative to perform remote system adjustments.

1) Remote Occupancy Adjustments: When requested within 6 months from date of Substantial Completion and project registration with lighting control system manufacturer, provide remote settings adjustments to suit actual occupied conditions. Provide up to 2 sessions to Project during other-than-normal occupancy hours for this purpose.

2) Prepare and submit report after each session that details activities performed.

END OF SECTION

SECTION 263100
PHOTOVOLTAIC SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Photovoltaic system requirements.

B. Photovoltaic modules.

C. Photovoltaic module mounting system.

D. Photovoltaic inverters.

E. Monitoring system.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. IEC 61215-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1: Test Requirements; 2021, with Corrigendum.

B. IEC 61215-1-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-1: Special Requirements for Testing of Crystalline Silicon Photovoltaic (PV) Modules; 2021.

C. IEC 61215-1-2 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-2: Special Requirements for Testing of Thin-Film Cadmium Telluride (CdTe) Based Photovoltaic (PV) Modules; 2021, with Amendment (2022).

D. IEC 61215-1-3 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-3: Special Requirements for Testing of Thin-Film Amorphous Silicon Based Photovoltaic (PV) Modules; 2021, with Amendment (2022).

E. IEC 61215-1-4 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-4: Special Requirements for Testing of Thin-Film Cu(In,GA)(S,Se)2 Based Photovoltaic (PV) Modules; 2021, with Amendment (2022).

F. IEC 61215-2 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 2: Test Procedures; 2021.

G. IEEE 1547 - IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces; 2018, with Amendment (2020).

H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

I. NECA 412 - Standard for Installing and Maintaining Photovoltaic (PV) Power Systems; 2012.

J. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 1699B - Outline of Investigation for Photovoltaic (PV) DC Arc-Fault Circuit Protection; Current Edition; Current Edition, Including All Revisions.

M. UL 1703 - Flat Plate Photovoltaic Modules and Panels; Current Edition, Including All Revisions.

N. UL 1741 - Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1) Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for photovoltaic system components.

2) Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3) Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Utility Interconnection:

1) Coordinate with local Utility Company prior to start of work for location of their net metering equipment, including CT enclosure provided under this Contract, per the Drawings, and any additional utility required disconnects which will also be provided under the Contract.

2) Arrange for inspections and secure permits necessary to obtain Utility Company approval of system.

3) Each PV system will be connected to the utility electric grid through a grid-interactive power conditioner (inverter). The design and functional specification of th ePV modules, power conditioners, utility interconnections, and PV system electrical design are described in the following articles.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

B. Design Data:

1) Include electrical calculations for array and associated equipment other than the basis of design products and configuration.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

D. Utility interconnection documentation.

E. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

F. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

G. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with Utility Company requirements for interconnection.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience with photovoltaic systems of similar size, type, and complexity.

1.7 WARRANTY

A. Photovoltaic Modules: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

B. Photovoltaic Inverters: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Photovoltaic Modules, Crystalline Silicon:

1) Canadian Solar (Basis of Design).

2) Hanwha QCELLS

3) SunPower

4) Trina Solar

5) LG

6) Or approved equal.

B. Photovoltaic Module Mounting System:

1) Design by others

C. Photovoltaic Inverters:

1) Chint Power Systems (Basis of Design).

2) Or approved equal.

D. Monitoring System:

1) Energy Toolbase.

2) Or approved equal.

2.2 PHOTOVOLTAIC SYSTEM REQUIREMENTS

A. Provide complete photovoltaic system consisting of photovoltaic modules and associated balance of system components necessary for connection to facility electrical system.

B. System Description:

1) Photovoltaic array is canopy-mounted in location indicated on the drawings.

2) Orientation of array is South.

3) System includes interconnection with utility grid (grid-tied system).

a) Utility metering configuration: Net metering.

4) System includes battery storage system.

5) System includes monitoring system.

C. Size:

1) Array: Designed to fit within the same area as the basis of design array.

D. Appearance:

1) Only systems with similar appearance to basis of design system will be considered.

2) Arrange array such that modules are aligned with uniform spacing.

3) Make no alterations affecting appearance of building exterior or interior without approval of Architect.

4) Final determination of acceptable appearance is by Architect.

E. Provide photovoltaic system and associated components suitable for wind loads, snow loads, seismic loads, and other structural design considerations of the installed location.

F. Provide photovoltaic system and associated components suitable for continuous operation under the service conditions at the installed location.

G. Provide products listed, classified, and labeled as suitable for the purpose intended.

H. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system.

I. DC Arc Fault Circuit Protection: Provide DC photovoltaic arc-fault protection devices listed as complying with UL 1699B as required for compliance with NFPA 70.

J. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

2.3 PHOTOVOLTAIC MODULES

A. Acceptable Module Types: Either crystalline silicon or thin film modules complying with specified requirements will be considered for this project.

B. General Requirements:

1) Photovoltaic Modules: Factory assembled; consisting of photovoltaic cells, frame, junction box, cables for series connection, and bypass diodes for shade tolerance; rated for 600 V DC; complying with IEC 61215-1 and IEC 61215-2 and listed as complying with UL 1703.

2) Crystalline Silicon Photovoltaic Modules: Comply with IEC 61215-1-1.

3) Thin Film Photovoltaic Modules: Comply with IEC 61215-1-2, IEC 61215-1-3, or IEC 61215-1-4 as applicable.

4) Frame: Anodized aluminum.

5) Factory-Installed Junction Box: Weatherproof, with factory-installed terminals and bypass diodes.

6) Factory-Installed Cables: Type USE-2 or listed photovoltaic (PV) wire with polarized locking connectors.

7) Unless otherwise indicated, specified module performance characteristics are rated under Standard Test Conditions (STC).

2.4 BALANCE OF SYSTEM COMPONENTS

A. Photovoltaic Module Mounting System:

1) Canopy-mounted system. Design by others.

B. Photovoltaic Inverters:

1) Provide inverter(s) as indicated or as required for connection of the photovoltaic array DC system to the AC system indicated.

2) Inverters: Suitable for the requirements of the connected array; output configuration compatible with connected system; listed as complying with UL 1741; furnished with the following features:

a) Maximum power point tracking (MPPT).
b) LCD display.

3) Grid-Tied Inverters: Comply with IEEE 1547, including over/under grid voltage and frequency protection, and anti-islanding protection to automatically disconnect upon loss of utility power and to remain disconnected until utility power restoration has been maintained for five minutes.

4) Total Harmonic Distortion: Less than five percent.

5) Enclosure Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

a) Outdoor Locations: Type 3R.

C. Batteries: As shown on drawings.

D. Monitoring System:

1) Provide a system to monitor photovoltaic system performance including all sensors, dataloggers, connections, software, equipment and accessories necessary for a complete operating system.

2) System communications interfaces to be wired or wireless, with compatible interconnected components.

   a) Provide suitable raceway, minimum 3/4 inch (21 mm) trade size, for all required wired connections.

3) System to monitor and record, in 15 minute intervals:

   a) Inverter status.
   b) Instantaneous power (kW).
   c) Cumulative energy production (kWh).

4) System real-time and historical data to be accessible from the following locations:

   a) Personal computer(s), via internet connection.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Mount equipment such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor, ground, or working platform.

D. Circuiting Requirements. in Addition to Requirements of Section 260519:

1) Wiring Methods:

   a) Unless otherwise indicated, use exposed type USE-2/RHH/RHW-2 single-conductor cable or listed photovoltaic wire (not routed inside building) for wiring between string(s) and transition junction box(es).
   b) Unless otherwise indicated, use type THHN/THWN-2 single-conductor building wire in suitable raceway for wiring between transition junction box(es) and point of interconnection.
   c) Secure exposed cables in accordance with NFPA 70. Where possible, conceal behind array.

2) Photovoltaic DC System Conductor Color Code:

   a) Negative Grounded System:
      Positive: Red.
      Negative/Grounded: White.
   b) Ungrounded System:
      Positive: Red.
      Negative: Black.

3) Maintain separation of photovoltaic and non-photovoltaic circuits in accordance with NFPA 70.

E. Grounding and Bonding Requirements, in Addition to Requirements of Section 260526:

1) Ensure that there is only one AC System bonding connection between grounding system and grounded/neutral conductor, including external connections and connections internal to equipment.

F. Identification Requirements, in Addition to Those Specified in Section 260553:

1) Color for Photovoltaic System Identification Nameplates and Labels: White text on red background, unless otherwise required by NFPA 70 or authorities having jurisdiction.

2) Use identification nameplate or means of identification acceptable to authority having jurisdiction to identify the presence of multiple power sources and the location of main service disconnecting means and each photovoltaic system disconnecting means. Locate at main service disconnecting means and at each photovoltaic system disconnecting means. Verify format and descriptions with authorities having jurisdiction.

3) Use identification nameplate to identify each photovoltaic system disconnecting means with text "PV SYSTEM DISCONNECT".

4) Use identification nameplate or identification label to identify systems equipped with rapid shutdown and associated rapid shutdown switch(es). Format, descriptions, and locations to comply with NFPA 70 and requirements of authorities having jurisdiction.

5) Use identification nameplate or identification label to identify the information required by NFPA 70 for marking of direct-current photovoltaic power sources. Locate at each DC disconnect means requiring marking.

6) Use identification nameplate or identification label to identify the interactive system point of interconnection at the disconnecting means as a power source and with the rated AC output current and the nominal operating AC voltage.

7) Use warning labels to identify electrical hazards for photovoltaic system disconnecting means. Include the word message "Warning - Electric Shock Hazard; Terminals on the line and load sides may be energized in the open position" or approved equivalent.

8) Use wire and cable markers to identify photovoltaic system source, output, and inverter circuit conductors at all points of termination, connection, and splices.

9) Use voltage markers, identification labels, stenciled text, or suitable permanent marking approved by authority having jurisdiction to identify exposed raceways, cable trays, pull boxes, junction boxes, and conduit bodies with the text "Warning: Photovoltaic Power Source" at maximum intervals of 10 feet (3 m) in accordance with NFPA 70.

3.3 SYSTEM STARTUP

A. Obtain Owner's approval prior to performing system startup.

B. Grid-Tied Systems: Obtain Utility Company's approval prior to performing system startup.

C. Prepare and start system in accordance with manufacturer's instructions.

3.4 CLEANING

A. Clean modules using only methods recommended by manufacturer to avoid scratches and other damage. Clean exposed surfaces on other components to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 COMMISSIONING AND DECOMMISSIONING

A. See Appendix A for commissioning and decommissioning requirements.

END OF SECTION

Appendix A – Battery Energy Storage System Commissioning / Decommissioning Plan

General Project Information

- **Project Name:** New Temperance Elementary School
- **DSA Application#:** A#02-123774, File# 10-126
- **Owner/Client:** Sanger Unified School District
- **Commissioning Objectives:** (1) Ensure compliance with specifications and standards,
  (2) Verify system performance and functionality,
  (3) Identify and rectify any issues before full operation, and
  (4) Provide documentation and training for operation & maintenance.
- **System Summary:**

Project Location	Sanger, CA
Min. Design Temperature	- 5˚C
Max. Design Temperature	65˚C
PV Module	(282) CSI SOLAR CS6W-545MB-AG
PV Module Wattage @ STC	545 W
PV DC System Size	153.7 kW DC
PV Inverter Type & Count	(3) CPS SCA50KTLDO/US-480 (50 kVA)
BESS Type & Count	(1) SOCOMEC SUNSYS-HES-L 150 kVA/406 kWh

- **Personnel:**

Team Member / Contact Information	Project Responsibility
Owner:	
Project Manager:	
Training Coordinator:	
Site Supervisor:	
Site Technicians:	
Safety Officer:	
Test Engineers:	
IT Specialist:	
Environmental Engineer:	
Safety Engineer:	

1. Phased Commissioning Activities

- **Phase 1: Pre-Commissioning**
    - **Personnel:** Project manager, lead engineer, site supervisor.
    - **Activities**:
        - **Design Review**: Verify that design meets specifications and regulatory requirements.
        - **Documentation Check**: Ensure all necessary documentation (manuals, schematics, etc.) are available.
        - **Site Preparation**: Confirm site readiness (e.g., electrical connections, environmental conditions).
        - **Commissioning Team:** Assemble commissioning team and corresponding contact information. Assign roles and responsibilities (e.g., project manager, engineers, technicians).
- **Phase 2: Equipment Installation Verification**
    - **Personnel**: Site technicians, safety officer.
    - **Activities**:
        - **Installation Check**: Confirm installation of all ESS components and controls. Check installation quality, safety equipment, and connections.
- **Phase 3: Functional Testing**
    - **Personnel**: Test engineers, IT specialists.
    - **Activities**:
        - **Equipment Tests:** Conduct battery module tests (capacity, performance), inverter and charge/discharge tests, and integration tests with grid or microgrid. Verify communication between components.
        - Safety Tests: Verify operation of safety systems (e.g., fire suppression, emergency shutdown).
- **Phase 4: Integrated System Testing**
    - **Personnel**: Safety engineer, environmental engineer.
    - **Activities**:
        - Perform integrated testing of fire and safety systems.
        - Validate thermal management systems.

- **Phase 5: Training and Documentation**
    - **Personnel**: Training coordinator, lead engineer.
    - **Activities**:
        - Prepare and provide O&M documentation.
        - Deliver training sessions for operation and maintenance staff.

2. ESS Components and Testing

- **Components to be Tested**:
    - Battery modules, inverters, control systems, safety devices (e.g., fire suppression systems, emergency disconnects).
- **Tests to be Performed**:
    - Capacity and performance tests for battery modules.
    - Inverter functionality tests (charge/discharge cycles).
    - Communication tests between components.
    - Safety device activation tests.

3. Testing Conditions

- Testing will be conducted under conditions that simulate normal operational scenarios, including:
    - Full charge/discharge cycles.
    - Ambient temperature ranges typical of operational conditions.
    - Expected load conditions based on usage forecasts.

4. Owner's Project Requirements

- Compile documentation that outlines:
    - Owner's performance expectations.
    - Safety requirements.
    - Compliance with local regulations.
    - Basis of design, including capacity, efficiency, and lifecycle requirements.

5. Installation Compliance

- Conduct inspections and testing to ensure that:
    - All equipment is installed according to approved plans.
    - Specifications for materials and installation methods are met.
    - Non-conformities are documented and addressed.

6. Integrated Testing for Fire and Safety Systems

- Perform tests that include:
    - Activation and response of fire alarms.
    - Functionality of fire suppression systems.
    - Emergency shut-off systems testing.

7. Thermal Management and Ventilation Systems Testing

- Conduct performance tests for:
    - Cooling systems (e.g., air conditioning, liquid cooling).
    - Ventilation rates and exhaust systems to ensure adequate airflow.
    - Monitoring of temperature and humidity within battery enclosures.

8. O&M Documentation Preparation and Delivery

- Compile and deliver:
    - Operation manuals.
    - Maintenance schedules.
    - Safety procedures and emergency response protocols.

9. Facility Operating and Maintenance Staff Training

- Develop a training program that includes:
    - System operation and monitoring.
    - Safety protocols.
    - Maintenance procedures and troubleshooting.

10. System Performance / Maintenance Requirements

- Document:
    - Key performance indicators (KPIs) for ongoing monitoring.
    - Scheduled maintenance tasks to ensure compliance with design intent.
    - Performance assessment of metrics and reporting protocols.
- Risk Management:
    - Identify potential risks during commissioning.
    - Develop mitigation strategies.

11. Qualified Personnel Identification

- Create a list of qualified personnel for:
    - Service and maintenance.
    - Emergency response procedures.
- Ensure documentation of training and certifications for all personnel.

12. Decommissioning Plan

- **Plan Overview**:
    - Outline procedures for safe shutdown of the ESS, including:
        - Notification to code officials and emergency services.
        - Detailed steps for disconnecting and isolating systems.
        - Safety measures for handling damaged systems.
    - **Contingencies**:
        - Procedures for intact operational systems.
        - Special protocols for systems damaged by fire or other incidents.

Conclusion

This commissioning plan is designed to ensure a systematic approach to the commissioning of the energy storage battery system. Tailor the specifics to align with the project's unique requirements and regulatory considerations. Regular updates and reviews should be incorporated as necessary throughout the commissioning process.

SECTION 266000
GENERAL CONDITIONS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary conditions, Divisions 0 and 1, specifications apply to work of this section.

1.2 GENERAL

A. All work must conform to the requirements which fall within the scope of the regulations in the Codes or under the jurisdiction of any of the governing bodies listed.

B. The California Code of Regulations, Titles 19 thru 24.

C. The California Electrical Code as applicable under current state and local regulations (latest edition and supplements).

D. State Board of Health.

E. CAL-OSHA Regulations.

F. Nothing in these Specifications or shown on the plans shall relieve the Contractor from full compliance with applicable portions of any of the above regulations pertaining to work which is installed under this Contract.

1.3 PERMITS AND FEES

A. Pay for and obtain all permits, inspection fees, etc., as required for the completion of all work included in this Contract. Any inspection Certificates required shall be obtained and delivered to the Owner.

1.4 EXAMINATION OF DRAWINGS AND SITE

A. Before submitting the bid, the Contractor shall carefully examine the Architectural, Structural, Mechanical and Plumbing Drawings for this work, along with the Specifications for same in addition to the drawings and specifications governing the work of this trade. The Contractor shall also visit the site of the proposed construction and familiarize himself with all the site conditions. No subsequent allowances will be made to the Contractor because of negligence in complying with the above or alleged inability to understand the requirements.

1.5 CONDUCT OF THE WORK

A. The Contractor shall maintain on the job a competent foreman or a superintendent at all times to superintend the work.

1.6 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall be responsible for the safety and good condition of all materials and equipment until final acceptance by the Owner. The Contractor shall erect and maintain suitable barriers, protective devices, lights, and warning signs where required for the protection of the public and employees about the buildings. The Contractor shall be fully responsible for any loss or injury to persons or property resulting from neglect or the carelessness and neglect by the Contractor’s employees.

1.7 SUBMITTALS

A. Shop drawings of power, signal, service, and distribution equipment and lighting fixture catalog cuts shall be submitted for approval in electronic format (PDF).

B. All shop drawings shall be submitted at one time in a neat and orderly fashion in electronic format (PDF) with a title sheet including Project, Engineer and Contractor, table of contents. 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.

C. Equipment or material furnished or incorporated in construction without prior approval of the Architect may be rejected and if rejected shall be removed from the structure and replaced with approved equipment or material at the Contractor's expense.

1.8 RECORD DRAWINGS

A. See General Conditions.

1.9 CATALOG DATA AND OPERATING INSTRUCTIONS

A. Upon completion of the work in this Contract, the Architect shall be furnished with a complete set of catalog data which describes each piece of equipment installed under this Contract. The catalog shall be bound in a set and shall be clearly labeled as to each item of equipment used.

PART 2 – PRODUCTS

2.1 LIST OF MATERIALS

A. Within thirty (30) calendar days after the award of the Contract, the Contractor shall submit PDF copies of a complete list of materials to be installed under this Contract, giving, in the case of each item of material to be used, the name of the article. All substitutes must be approved by the Architect as stipulated in Section 01620.

PART 3 - EXECUTION

3.1 GENERAL

A. The work as laid out is to some extent diagrammatic, and the location thereon indicated may be approximate only. The Contractor, therefore, shall install all the equipment, apparatus, conduit runs and the like as follows:

B. Adhere to the location indicated as far as possible.

C. Maintain ample head room in all rooms and passageways, clearance around all apparatus and equipment and under pipelines for unrestricted passage and for easy servicing of all apparatus, equipment, devices and the like.

D. Verify the exact locations of all fixtures and other apparatus or devices as indicated on the drawings. In the event these drawings do not sufficiently indicate the locations for all such fixtures, apparatus or devices, the Contractor shall obtain the exact locations from the Architect.

3.2 CUTTING AND PATCHING

A. This Contractor shall do all cutting and patching of the work for the installation of the equipment and materials as approved by the Architect and/or Engineer. All patching shall accurately match the adjoining work.

3.3 BORING

A. Provide mechanical boring equipment to bore under existing asphalt, concrete, or other surfaces or objects as noted on the drawings. All borings shall be a minimum of 24” under the substrate material unless otherwise authorized by the Architect.

B. Holes shall be bored not to exceed 1” larger diameter than the largest component remaining in the excavation.

C. Water or air pressure jetting are not permitted, unless they comply with the following requirements:

1) All surfaces of the hole can be visually inspected with 6’ maximum length.

2) All objects shall be supported continuously to prevent sagging.

3) The hole shall be filled with compacted damp sand and inspected by the Project Inspector or Materials Testing Lab technician.

3.4 FOUNDATIONS AND SUPPORTS

A. This Contractor shall provide all foundations, supports and hangers, etc., as required to install the equipment as specified or shown on the drawings. All equipment shall be supported, braced and cross-braced in such manner as to prevent sway and/or lateral movement.

3.5 EXCAVATION AND BACKFILLING

A. Excavating required for the installation of the work shall be done by this Contractor. Underground lines outside the buildings shall be installed with a minimum cover of 24" except depth of utility services shall comply with respective utility company requirements.

B. The conduit shall be laid on material described below to afford bearing for the full length of the conduit. Any part of the trench excavated below grade shall be corrected with thoroughly compacted material approved by the Architect.

C. When the bottom uncovered at subgrade is soft and, in the opinion of the Architect, cannot support the conduit, a further depth shall be excavated and refilled to conduit foundation grade as required by the Architect.

D. Backfill:

1) 6" Below, Around, and to 6" Above Conduit: Material shall be sand. Place carefully around and on top of conduit, taking care not to disturb conduit. Consolidate with vibrator.

2) 6" Above Conduit 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.

E. No excavation below the level of, or adjacent to, foundations of footings shall be made except in a manner approved by the Architect.

F. A red or yellow tracer tape stating "CAUTION ELECTRIC LINE BURIED BELOW" shall be installed 12" above conduit, full length of trench.

G. Electrical conduit shall not be run in excavations provided for plumbing or heating pipes, unless separated by a minimum of 12 inches.

H. Verify location of all underground lines with Owner and utility companies before starting excavation. If any utility company facilities are identified and located within the perimeter of the building, the Contractor shall stop work, promptly notify the Architect, and secure instructions.

I. Ten (10) days before doing any excavation or trenching, contact "Underground Service Alert," 1-800-642-2444, advise them of work schedule and comply with their recommendations.

3.6 CLEANING UP

A. The Contractor shall keep the premises free from accumulations of waste material or rubbish. At the completion of the work, he shall remove all rubbish, tools, scaffolding and surplus materials from and about the buildings, leaving the premises in a clean condition.

B. All exterior surfaces of exposed equipment and material shall be thoroughly cleaned of all dirt, cement, plaster and other debris, including the exterior surfaces of all conduit, conduit fittings, conduit hangers, insulation and the like.

C. All surfaces to be painted shall be carefully wiped or otherwise cleaned; cracks and corners scraped out clean, grease and oil spots removed so that surfaces may receive paint without further preparation.

D. All fixtures and plated materials shall be thoroughly cleaned and polished.

3.7 DAMAGE BY BREAKS

A. The Contractor shall be responsible for all damage to any part of the premises caused by breaks in conduit or fixtures furnished and/or installed by him under this specification for a period of one (1) year from date of acceptance of the project by the Owner.

3.8 SITE CONDITIONS

A. Where existing utilities are shown on the plans, extreme care shall be exercised in excavating near these utilities to avoid any damage thereto, and the Contractor shall be held responsible for any such damage caused by this operation.

B. The general location and arrangement of conduit, equipment apparatus, etc., as shown in the drawings or herein specified and all installations shall be made in accordance therewith. Information on the drawings relative to existing services is approximate only. Minor deviations required to conform to actual locations shall be made without additional cost to Owner.

C. Should existing utilities, not shown on the plans, be found during excavations, or identified, the Contractor shall promptly notify the Architect for instructions as to further action. Failure to do so will make the Contractor liable for any damage arising from the operations after discovery of such utilities not shown on the plans. These utilities shall be removed or relocated as directed by the Architect. An equitable adjustment in the Contract will be made for the additional work involved.

D. The Contractor shall use special precautions where excavations are made in the areas near electrical ducts since they may be high voltage ducts. All such ducts shall be exposed by careful hand excavation so as not to damage the ducts or cause injury to personnel and shall be suitably marked with warning signs, barricades, etc. as required.

3.9 STANDARD PRACTICE

A. All work not shown in complete details shall be installed in conformance with the best standard practice for the trade.

3.10 INTENT

A. It is the intention to provide systems that are complete in every respect without further cost to the Owner. Anything not shown in drawings, or indicated in the specifications, but required for complete operating systems shall be included as part of this Contract. This shall include all connections to existing services.

3.11 SPECIAL NOTE

A. Attention of Contractor is hereby called to all work covered by notes on the drawings. Work covered by notes must be furnished and installed whether it is specifically mentioned in these specifications or not.

3.12 GUARANTEE

A. Except as otherwise specified, all materials, apparatus equipment furnished and installed under the Electrical Section of this specification shall be new and free from all defects. Should any trouble develop within a period of one (1) year from date of acceptance of the work, due to inferior or faulty material and/or workmanship, the trouble shall be corrected, and material and equipment replaced by the Contractor without expense to the Owner.

3.13 SERVICES

A. The location of any existing utility services shown on the drawings is approximate and shall be checked by this Contractor for exact location. Refer to “EXCAVATION AND BACKFILLING” for additional requirements.

3.14 ACCESS OPENINGS

A. It shall be the responsibility of the Contractor to provide sufficient and convenient access openings, panels, etc., in the building construction where required for the maintenance of, installation and/or removal of all equipment, or other items of the various systems and equipment.

3.15 PURCHASE ORDERS AND ACCEPTANCE

A. The Contractor shall file with the Architect two (2) certified copies of all purchase orders, for materials, equipment, appliances, and rentals thereof within two (2) weeks from date of Notice to Proceed with the Contract if requested by the Architect.

B. The Contractor shall file with the Architect two (2) certified copies of acceptance of purchase orders for materials, equipment, and appliances by the manufacturer, distributor, or wholesale house within six (6) weeks from the date of Notice to Proceed with the Contract if requested by the Architect.

C. Failure to provide same within the stipulated time shall be deemed sufficient cause for the Architect to withhold certificates of payment for work completed or materials and equipment provided by the Contractor or subcontractors toward the completion of their Contracts.

END OF SECTION

SECTION 267000
BASIC ELECTRICAL MATERIALS AND METHODS

FIPART 1 – GENERAL

1.1 REFERENCE STANDARDS

A. UL 845 - Motor Control Centers; Current Edition, Including All Revisions.

B. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary conditions, Divisions 0 and 1 and Section 26 6000 specifications apply to work of this section.

1.3 SCOPE OF WORK

A. This portion of the work includes the furnishing of all labor and materials necessary for the complete wiring system to outlets and all equipment shown on the drawings or covered by this Section of the Specifications and other Division 26 and Division 28 sections of the Specifications. In general, the work includes the following:

1) Complete system of branch circuit wiring, conduit and distribution equipment for lights, receptacles, and power.

2) Furnish and install lighting panelboards, lamps, lighting fixtures, wall switches, convenience outlets, etc. as shown on drawings.

3) All hangers, anchors, sleeves, chases, and supports for fixtures, all electrical equipment and materials.

4) Furnish, install, and connect wire, conduit, and switches, etc. required for other equipment covered by other sections of these Specifications.

5) All excavating and backfill as required for electrical work.

6) The patching and repair of all work modified or damaged by the installation of work under this Contract.

7) Outlet boxes and conduit system for telecommunications (voice and data).

8) Demolition work.

9) Terminal cabinets and backboards.

10) The Contractor shall furnish and install all work necessary to make complete systems, whether or not such details are mentioned in these Specifications or shown on the drawings, but which are necessary in order to make complete working systems, excepting only those portions that are specifically mentioned therein or plainly marked on the accompanying drawings as being installed by other Contractors.

11) Electrical Contractor must coordinate his work with the work of other trades so as to provide raceways, conductors and outlets in the correct location for the equipment served, including all built-in appliances, mechanical, and signal equipment and connect same. Electrical Contractor must provide power of the correct voltage and phase to each item of equipment.

12) Before construction starts, the Electrical Contractor shall arrange a coordination meeting with the General Contractor and all other subcontractors supplying equipment that requires electrical connections. All electrical requirements shall be verified, and any problems shall be immediately reported to the Architect. Equipment items to verify shall include, but not be limited to: Voltage, amps, phase, location, orientation, space requirements, type of connection, starter and disconnect location and provision, control system operation and requirements, etc.

13) The above list is given for the convenience of the Contractor and is not considered all-inclusive.

14) Complete system of conduits, substructures and equipment for power, telephone, and cable television services. The Electrical Contractor shall inform the respective utility companies that the project has been started and confirm that all forms, which are required for the Application for Service, have been completed and submitted to the Utility Company. The Electrical Contractor shall obtain a copy of the approved engineering drawings prior to construction.

1.4 TEMPORARY CONSTRUCTION POWER

A. Provide a temporary construction power system that is adequate for this project. Coordinate requirements and details with the General Contractor. All 120V, 15A and 20A receptacles shall have ground fault circuit interrupter protection.

1.5 WORK NOT INCLUDED

A. A. The furnishing and installation of motors.

B. Access panels.

1.6 COORDINATION WITH MECHANICAL WORK

A. The Mechanical Contractor shall furnish equipment such as motors, starters, thermostats, wiring diagrams, etc. However, the Electrical Contractor shall be responsible for furnishing and installing of all fused disconnect switches, conduits, wire, fittings, etc. for power connections.

B. Install all electrical equipment where it is not already installed as a part of a unit furnished by the Equipment Contractor. (See drawings of respective contractors).

C. The Electrical Contractor shall furnish fused disconnect switches for pumps, motors and air conditioning and handling units, if they are not furnished by others. Fuses shall be dual element, rating per equipment manufacturer's recommendations. Disconnects shall comply with requirements for "Motor Disconnects" as specified earlier in this section.

D. All disconnect switches (whether provided with unit or by Contractor) shall have a circuit identification engraved nameplate as specified under "Motor Disconnects".

E. Thermal overload protection shall be furnished for all motors where such protection is not included as a part of another contract.

F. All motor outlets, disconnect switch locations and control outlets shown on the plans are approximate only. Verify exact location of same with Equipment Contractor.

G. All line and low voltage controls, including conduits, outlets, wiring and connections shall be furnished and installed by the Mechanical Contractor. (Division 23).

H. Furnish and install a weather-resistant duplex receptacle with ground fault circuit interrupter protection within 25 ft. of all rooftop H.V.A.C. units. Provide a diecast weatherproof "while-in-use" lockable cover, Red Dot #CKSUV or equal.

I. Coordinate with General Contractors, Mechanical Contractors and equipment suppliers before bid is submitted and again before rough-in is started to verify that all systems are complete and all components are provided including starters, disconnects, relays, solenoids, control conduit and wire, etc.

PART 2 - MATERIALS

2.1 GENERAL

A. All materials, appliances, and equipment except that furnished by the Owner shall be new, bear U.L. Label and of the make, brand or quality specified or as accepted by the Architect as herein provided. This shall also apply to all parts of the work whether or not this particular paragraph is referred to by number.

B. All apparatus, conduit systems, etc., shall be installed and interconnected so as to form complete systems as herein specified and/or shown on all the accompanying drawings. This Contractor shall furnish and install all work necessary to make complete working systems, excepting only those portions that are specifically mentioned herein or plainly marked on accompanying drawings as being furnished by other contractors.

2.2 MAIN SWITCHBOARD

A. Dead front, dead rear, floor standing, consisting of underground pull section, main section with main circuit breaker and equipment to accommodate power company's current transformer and meter, distribution section and sub-feed circuit breakers as shown on drawings. Main switchboard shall be as manufactured by Square D, General Electric, Eaton, Siemens or approved equal.

B. Circuit breakers shall be molded case type, quick-make, quickbreak, with thermal magnetic trip. Size and rating shall be as shown on the drawings. All circuit breakers shall be bolt-on type. Two and three pole breakers shall have integral internal common trip. All circuit breakers, rated 100 amps and larger, shall be equipped with adjustable instantaneous trip settings.

C. Finish shall be one coat of rust-inhibiting primer and two coats of gray enamel.

D. Full-size buses shall extend the full height of the distribution section. A copper ground bus shall be provided firmly secured to each vertical section structure and shall extend the entire length of the switchboard.

E. Section or sections shall be fully bussed with either copper or tin-plated aluminum bussing with all hardware in place for future devices. The bussing shall be braced to withstand the fault current of 50,000A symmetrical minimum. Filler plates as required shall be supplied with two handles on each plate. Sub-feed devices shall be of the types indicated on the drawings and shall be lockable in the "Open" position. A nameplate shall be supplied for each device in each section of each switchboard affixed to the switchboard trim adjacent to device and indicating name of device as shown one line diagram. Black letters shall be minimum ¾" high on white background.

F. All circuit breakers in the main switchboard shall have short circuit current interrupting capacity exceeding the maximum available at service transformer. Contractor shall be responsible for obtaining fault current information from serving Utility Company prior to fabrication of main switchboard. The main switchboard shall have an integrated short circuit current interrupting rating of a minimum of 30,000A symmetrical, or greater if indicated on drawings.

G. Underground pull sections shall be manufactured by the same manufacturer of the switchboard and per the serving Utility Company's requirements.

H. The Electrical Contractor shall submit electronic PDF copies of the main switchboard shop drawings to the Serving Utility Company for their approval prior to fabrication of the main switchboard. All main service boards shall meet the providing utility's requirements for underground pull sections, meter sections, and main breaker(s) sections.

2.3 PANELBOARDS

A. The panelboards shall be constructed in accordance with the standard set up by the Underwriters' Laboratories, Inc., and as manufactured by Square "D", General Electric, Eaton, Siemens or approved equal, and each shall contain the number and type of circuit breakers as indicated on the drawings. All circuit breakers, rated 100 amps and larger, shall be sub-feed type and equipped with adjustable instantaneous trip settings.

B. The panelboards shall be equipped with a hinged lockable door, piano hinged trim, and typewritten circuit directory. All finish in offices, corridors, or areas subject to public view shall be prime coat for finish coat by painter. In storage rooms, equipment rooms, etc., finish shall be standard factory gray Hammertone. Provide a flush lock on all panelboards.

C. Provide an engraved Bakelite nameplate, fastened with screws or rivets to the face of each panelboard, which will identify it.

D. Any panel with an isolated ground bus shall have a nameplate stating, "IG CIRCUITS". Nameplate to be same size and color and adjacent to panel designation nameplate.

E. Electrical contractor shall provide electronic PDF copies of detailed construction drawings for the panelboards and terminal cabinets shall be submitted to the Architect for Approval before their construction is started.

2.4 MAGNETIC STARTERS

A. Motor Starters shall be across-the-line magnetic type rated in accordance with NEMA Standards, sizes, and horsepower ratings, mounted in general purpose enclosures, or NEMA 3R as required. All starters shall be full voltage, non-reversing, unless otherwise noted. Thermal overload relays on starters shall be non-compensated bimetallic type with selector for either auto or manual reset. Overload heater units shall be provided in each leg of starter unit. Each starter shall have 2 auxiliary interlock contacts.

B. Each starter shall have 120-volt control transformer and HOA selector switch mounted on cover.

2.5 TERMINAL CABINETS

A. Provide a Bakelite nameplate fastened with screws or rivets to the face of each terminal cabinet, which will identify it.

B. Provide circuit directory and holder on inside of door with one line for each conductor entering and each conductor leaving cabinet.

2.6 RACEWAYS AND FITTINGS

A. Shall be manufactured by Allied Tube and Conduit Corporation, AFC Cable Systems, Inc., Carlon, Cantex, PW Pipe or approved equal.

B. Galvanized rigid steel conduits (RSC) may be used in all locations.

C. For underground runs in direct contact with earth, conduit shall be wrapped with PVC tape or shall have factory applied PVC coating.

D. Galvanized intermediate metallic conduit (IMC) may be used in indoor locations not in direct contact with earth.

E. Galvanized electrical metallic tubing (EMT) may be used in indoor dry locations in which it is:

1) Not subject to physical damage.

2) Not in direct contact with earth.

3) Not in concrete slabs.

4) Not in hazardous areas.

5) On roof or walk cover when specifically shown on drawings.

6) In masonry walls, not in the same cells as rebars.

F. Non-metallic rigid conduit shall be PVC Schedule 40 and may be used:

1) Underground.

2) Below concrete slab on grade.

3) In concrete slab on floors above grade.

4) In masonry walls, not in same cells as rebars.

G. Flexible steel conduit may be used in dry locations for final connections to:

1) Motors, transformers, and other mechanical equipment, not to exceed 18 inches.

2) Lighting fixtures, not to exceed 72 inches.

3) Facilitate wiring in tight locations, when approved by Engineer.

H. Flexible aluminum conduit may be used in walls or in attics to facilitate wiring in tight locations, when approved by the Engineer.

I. Liquidtight flexible steel conduit shall be used in outdoor or wet locations for final connection to motors or other mechanical equipment, not to exceed 18 inches.

J. Fittings:

1) For rigid and intermediate steel conduits, fittings shall be:

a) Galvanized rigid steel threaded type.
b) Provide insulated grounding bushings at switchboard enclosures and panel enclosures for feeders.

2) For electrical metallic tubing (EMT), fittings shall be:

a) Zinc plated steel set screw type in dry locations.
b) Zinc plated steel compression type for conduits larger than 1”, in wet locations and in masonry walls.
c) All connectors shall have an insulated throat.

3) For non-metallic conduits, fittings shall be PVC Schedule 40 type. Use PVC schedule 40 adapters at all boxes and panelboards.

4) Brush or dauber apply PVC cement.

5) For flexible metallic conduits, fittings shall be zinc plated steel/malleable iron squeeze type.

6) For liquidtight flexible metallic conduits, fittings shall be zinc plated steel/malleable iron compression type.

7) Use of the following is prohibited:

a) Crimp-on, tap-on or indenter type fittings.
b) Spray (aerosol) PVC cement.

2.7 PULL BOXES

A. Pull Boxes shall meet all code requirements as to size for conduits terminating therein and to thickness of material used in fabrication.

B. Fabricated sheet steel pull boxes shall be installed only in dry, protected locations and shall be furnished with knockouts and removable screw cover. The box shall be finished with one coat of zinc chromate and a coat of primer sealer and where exposed to public view shall be painted to match the surrounding surface.

C. Weatherproof sheet steel pull boxes shall be fabricated of code gauge galvanized sheet steel with two coats of rust resistant finish and shall be furnished with gasket and made completely weathertight.

D. Approved manufacturers for metal boxes are Cooper B-Line, Milbank, Hoffman or approved equal.

E. Weatherproof concrete pull boxes, junction boxes and telephone boxes shall be manufactured by Christy Concrete Products, Utility Vault or approved equal. All pull boxes shall be H/20 rated and be equipped with H/20 rated galvanized steel checker plate cover with the inscription “Electric, Lighting, Fire Alarm or Signal”.

2.8 TIME SWITCHES

A. Time switch shall be a two-circuit digital time clock with photo control input, battery back-up and a surface enclosure. Provide a flush enclosure when indicated. Tork #DGLC (120V) or DGLC-3 (277V) or approved equal.

2.9 OUTLET BOXES

A. All outlet boxes shall be standard one or two piece galvanized knockout outlet boxes. Raco, Appleton, Thomas and Betts or approved equal.

B. All outlet box covers, rings or other fittings shall be standard galvanized. Raco, Appleton, Thomas and Betts or approved equal.

C. No outlet box shall be smaller than four inches (4”) square and 1 ½” in depth, except in concrete block construction where Thomas and Betts concrete masonry boxes are approved.

D. Floor outlets on grade shall be fully adjustable type floor boxes, suitable for use in concrete floors. Wiremold #RFB6E-OG with a Wiremold #8CTC2NKTR Evolution cover assembly. Where floor box is installed in a bare concrete floor, provide a Bare Concrete and Terrazzo ring, Wiremold #RFB6E-CTR with a Wiremold #8CT2NKTR Evolution cover assembly.

E. Cover shall be die-cast aluminum with nickel finish, unless otherwise noted on drawings. For 120V power, provide an industrial specification grade 20A 125V duplex receptacle with internal duplex receptacle bracket #RFB6DP, quantity as shown on drawings. For data/telephone, provide a decorator

style receptacle bracket #RFB6GFI for mounting frame to accept the modular telephone/data jacks, unless otherwise noted on drawings. Any unused device compartments shall be covered with internal blank bracket #RFB6B.

F. All special outlets shall be as hereinafter specified or as shown on drawings.

G. Thru boxes are not permitted.

H. Any unused boxes shall be equipped with a blank cover plate.

2.10 RECEPTACLES

A. Furnish and install an industrial specification grade 20A, 125-volt, 3 wire grounding type tamper-resistant duplex receptacle with one piece brass mounting strap at all receptacle outlets as indicated on drawings. Leviton #5362-SGW or equal as manufactured by Hubbell, Pass and Seymour, Eaton, or other approved manufacturers.

B. Device color shall be white.

C. Tamper-resistant isolated ground duplex receptacles shall be 20A, 125V NEMA 5-20R, orange in color. Leviton #T5362-IG or approved equal.

D. Tamper-resistant G.F.C.I. duplex receptacles shall be provided for 15 and 20-amp 125-volt circuits where required by the C.E.C. #210.8 and #590.6. At indoor locations, provide Leviton #G5362-0TW or equal. At exterior locations, provide weather and tamper-resistant type G.F.C.I. duplex receptacles, Leviton #G5362-WTW or equal. At damp locations, provide a diecast weatherproof lockable cover, RACO # 5028-0 or equal. At wet locations, provide a diecast weatherproof “while-in-use” lockable cover, Red Dot #CKSUV or equal.

2.11 LOCAL SWITCHES

A. Furnish and install industrial specification grade, quiet type toggle switches, 20 AMP rated 120/277V AC only, controlling wall and ceiling outlets as indicated on the drawings. Leviton #1221-2W or equal as manufactured by Hubbell, Pass and Seymour, Cooper or other approved manufacturers.

B. Where two or more switches are in proximity they shall be ganged in the same box, and they will be set under one plate. Switches controlling lights and/or outlets on emergency power shall be kept entirely independent of all other switches not on emergency power by mounting in a separate box.

C. Special receptacles or switches shall be as noted on the drawings.

D. Where key switches are noted on the drawings, provide Leviton #1221-2KL.

E. Device color shall be white.

F. When a switch is used as a disconnecting means, it shall be mounted in a readily accessible location.

2.12 WALL PLATES

A. All wall plates for electrical outlets and devices shall be smooth stainless steel, non-magnetic type 302S.

B. All telephone outlet plates shall be blanked plates, same as device plates.

2.13 CONDUCTORS (WIRE)

A. All wire installed in this contract shall be of a standard manufacturer as approved by the National Board of Fire Underwriters and be of the size as indicated on the drawings. All wire shall bear the Underwriters' label and shall be brought to the job in unbroken packages and approved by the Job Inspector before it is installed.

B. All power conductors #10 AWG and smaller shall be type THWN copper, unless otherwise noted. All conductors #8 AWG and larger shall be type THWN-2 copper, unless otherwise noted.

C. All underground conductors in a 480V or 480/277-volt power system shall be type XHHW-2 copper, unless otherwise noted.

D. Number 12 AWG wire shall be the smallest gauge wire used, except for signal circuits, which shall be as shown on plans or as specified under other sections of these specifications.

E. All wire #8 AWG gauge or larger shall be stranded.

F. The neutral conductor of all lighting feeders shall be of the same size as the phase conductors.

G. Splices on all wire less than #8 gauge shall be with insulated spring connectors Ideal "Wing Nuts", 3M "Scotchlok", or equal.

H. Splices in wires #8 gauge and larger shall be made with crimp on solderless connector, 3M Scotch, Burndy or equal. Connectors to switches or bus bar shall be made with one-piece lugs for all wires, sized for conductors as shown on the plans.

I. Each branch circuit shall be marked with the circuit number at the panel and at the first outlet nearest the panel. E-Z Code Markers (Thomas and Betts) or equal shall be used to label the circuits.

2.14 LIGHTING FIXTURES

A. This Contractor shall submit for approval electronic portfolios, PDF format, with full description and manufacturer data sheets of all fixtures (including ballasts and lamps), that are proposed to use.

B. This Contractor shall furnish and install all lighting fixtures and lamps as indicated on the Electrical Drawings and in accordance with these specifications.

C. This Contractor shall be held responsible for the complete equipment of all fixture outlets with fixtures of the proper design as shown.

D. All fixtures shall be securely anchored to prevent any possible chance of their falling.

E. Continuous runs of fixtures shall be installed straight and true.

F. Recessed fixtures shall be complete with plaster frames, supporting brackets and hanger wires.

G. Stem lengths shall be adjusted to meet conditions where required. Furnish aligners to ensure vertical alignment (ball aligner).

H. Electrical Contractor shall coordinate outlets with Acoustic Tile Contractor and other trades and locate outlets in the center or at intersections of acoustical tile in all acoustical tile ceilings.

I. Recessed fixtures in t-bar ceilings shall be attached to t-bar ceiling with integral

J. t-bar clips, two at each end of fixture.

K. When the light fixture is equipped with an integral emergency battery pack, the light fixture shall be connected so that it is controlled via the room light switch and is automatically energized when power has fails.

2.15 PHOTO CONTROL

A. Paragon or equal, adjustable type.

2.16 MOTOR DISCONNECTS

A. Disconnects shall be fused safety switches with dual element fuses. Heavy Duty rated with quick-make, quick-break operating mechanism. Fuse rating shall comply with motor manufacturer's recommendations. Switch shall be UL listed. Disconnects shall have an external operating handle, lockable in the open or closed position.

B. Disconnect switches shall be located so as not to obscure any part of the HVAC unit's nameplate data.

C. Each disconnect switch shall have an engraved Bakelite nameplate identifying the panel and circuit number that feeds the motor. Nameplates shall comply with specifications for "Identification of Switches and Apparatus".

2.17 DRY TYPE TRANSFORMERS

A. Transformer shall be Class H insulation with temperature rise not exceeding 115 degrees C., in a maximum ambient of 40 degrees C., with rated nameplate load connected to the secondary side, at rated voltage. Unless otherwise noted, the transformer shall comply with the Energy Efficiency levels mandated by the Department of Energy.

B. Transformer shall be built in accordance with the latest revised IEEE, ANSI and NEMA standards.

C. Case temperature shall not exceed 35 degrees C., above ambient.

D. Designs shall incorporate built-in vibration dampening systems.

E. Terminal compartment shall be located to ensure termination of cable leads in temperature levels not to exceed 60 degrees C., and to provide for side or bottom entrance of conduit. Enclosures shall be weatherproof and rodent proof. Ventilation openings shall be louvered type. Screening will not be acceptable.

F. Transformer shall be furnished with 2 taps above and below rated voltage, each 2 ½%.

G. Transformer shall be suitable for non-linear loads and have a U.L. rating of K-4, when indicated on the drawings.

H. Acceptable manufacturers shall be Square "D", General Electric, Eaton, Siemens or approved equal.

2.18 TELEPHONE CABLES

A. When telephone cables are indicated on drawings, they shall be Category 3, 24 AWG, unshielded twisted pairs with 4 pairs minimum, COMMSCOPE #3504 or equal. If in a plenum, use plenum rated cable, COMMSCOPE #35N4 or equal.

PART 3 - EXECUTION AND INSTALLATION

3.1 CONDUIT SYSTEMS

A. A concealed conduit system shall be installed for all interior wiring including controls. Conduit shall be run continuously between outlets, etc., and with the minimum number of bends.

B. PVC 40 shall be used for underground runs.

C. Where underground conduit cannot be run below building footings and the Contractor shall provide PVC-80 sleeves through the footings (Contractor shall obtain approval for all sleeve sizes and locations with the Structural Engineer before installation).

D. All conduit shall be delivered to the site of construction in their original bundles. Each length of conduit shall bear the label of the National Board of Fire Underwriters. All conduit subjected to rough usage while on the job before installation and not acceptable to the Architect shall be removed from the premises upon notice.

E. Conduit installed in masonry walls shall be rigid steel galvanized conduit, PVC or EMT, not in same cell as re-bars.

F. The joints in all conduits installed under concrete slabs on the ground, or underground, or exposed to the weather, shall be made liquid and gas tight. All underground conduit outside of the buildings shall be buried to a depth of not less than 24” below finish grade. Utility services shall comply with utility company requirements. Two or more conduit runs installed in a common trench shall be separated horizontally by at least four inches (4”). Electrical conduit runs installed in a common trench with other utility lines shall be separated horizontally from such lines by at least twelve inches (12”). Provide a detectable warning tape, 12” above the top of the conduit and the full length of trench.

G. Changes in direction shall be made with conduit elbows or long radius bends made on the job. Where two or more conduits are grouped in exposed locations, the sweeps shall be struck from the same center forming concentric arcs.

H. All joints in conduit shall be made with standard coupling. In making joints, conduits must be truly and accurately cut and threaded (where applicable) with straight thread, smoothly reamed and squarely butted. All conduit shall be kept corded and dry during construction, using plastic caps or conduit pennies held in place with conduit bushings. Should dirt or moisture collect in any conduit, the Contractor shall swab them out to the satisfaction of the Architect.

I. Conduits ending at the motors shall be carried as close as possible to the terminal blocks making allowance for the movement of the motors when they are equipped with slide rails. The connection between the conduit terminals on the motor and the conduit shall be made with liquid-tight flexible conduit using the proper fittings.

J. All conduits where they enter panel enclosures, pull boxes, or outlet boxes shall be secured in place by galvanized locknut inside of box.

K. Where conduits are run exposed, they shall be installed straight and true with reference to the adjacent construction.

L. Any conduit installed under the building shall be under the slab. The top of any conduit below floor slab shall be a minimum of 4” below the bottom of the concrete slab.

M. All boxes for bracket outlets shall be equipped with a 3/8” “No-Bolt” fixture stud. These boxes shall be so set that when in place the fixture shall be at right angles to the ceiling or walls.

N. All empty conduit shall be equipped with a nylon pull rope continuous from outlet-to-outlet or end-to-end.

O. Flexible conduit will be permitted for connecting lighting fixtures to junction boxes.

P. Flexible connections in outdoor and damp locations shall be flexible liquid-tight metal conduit or non-corrosive seamless metallic tubing with watertight connections.

Q. Install roof jacks for this construction in accordance with other sections of this Specification.

R. The maximum allowed length of flex conduit at equipment connections is 18".

S. Expansion joints for conduit shall be provided where required to compensate for thermal expansion and contraction.

T. At all sub-panels and terminal cabinets, stub two 1"C and two ¾"C into the accessible attic space. If the attic space is not accessible, stub conduits to a location as directed by Architect or Engineer. Provide additional conduit stubs when indicated on the drawings.

U. Support conduits on roof with prefabricated pipe supports (B-Line "Dura-Blok Series" or equal), spaced 8 ft. O.C. maximum. Minimum clearance from roof to framing channel shall be 4". Framing channel length shall be as required plus 50% spare length. Installation shall comply with manufacturer's recommendations.

V. Any conduit entering underground pull boxes shall be sealed to prohibit water from entering the conduit. Conduits with conductors shall be sealed with a sealing compound after all conductors have been installed. All spare (empty) conduits shall be identified with either the "origination" or "destination" (example: to pull box 150' to the south, from Main Switchboard, etc.). The contractor shall use a scrap piece of ¾" PVC conduit, approximately 5" in length and tie the nylon pull string thru it. Write the description on the conduit using an indelible/permanent marker.

3.2 OUTLETS

A. In general, the locations of electrical outlets shall be as shown on the drawings; however, the Contractor shall make any changes necessary to suit conditions on the job or rearrangement of built-in fixtures and equipment as directed by the Architect or his representative.

B. The Contractor shall study the general building plans with relation to spaces surrounding each outlet in order that his work may fit the work of others and that when fixtures or other equipment are installed, they will be symmetrically located according to room layout. Refer all conflicts and discrepancies promptly to the Architect.

3.3 OUTLET BOXES

A. Outlets for concealed wiring shall be flush with the finished wall or ceiling surfaces. Pull boxes, junction boxes and all others to which no fixture or device is to be attached, shall be fitted with blank cover plates, and painted to match surroundings. In order to reduce noise transmission between rooms, outlet boxes shall not be installed back-to-back. Where outlets are side by side and faced into opposite rooms, the boxes shall be at least 6" apart, except in fire rated walls space boxes at least 24" apart. If the boxes are connected together, the connection shall be flexible and shall have openings packed with fiberglass.

B. The Electrical Contractor shall inform himself of wall thickness throughout the building and shall provide outlet boxes of suitable depth that can be flush mounted and yet will be deep enough to contain the particular apparatus involved. The location of exposed pull or junction boxes will be subject to the Architect's approval.

C. Outlets from which lights are suspended shall have approved 3/8" fixture studs fastened through from back of box. All outlet boxes and particularly those supporting fixtures shall be securely anchored in place in an approved manner. Support outlet boxes and fixtures in acoustic ceiling areas from building structures, not from acoustic ceilings. All lighting fixture outlets shall be coordinated with mechanical, architectural, or other equipment to eliminate conflicts and provide a workable, neat installation.

D. Where more than one switch occurs at the same location, use multiple gang outlet boxes covered by a single plate; provide box partitions as required by the C.E.C. Switches controlling lights and/or outlets on emergency power shall be kept entirely independent of all other switches not on emergency power by mounting in a separate box.

E. Outlet box extensions shall be UL listed and shall be attached to box with threaded metal screws. "Flash guards" are not permitted to be used as box extensions.

3.4 LOCATIONS OF OUTLETS

A. The Architect reserves the right to make reasonable changes in the indicated locations before work is roughed in without additional charge to the Owner.

B. Where wainscot occurs at the 4'-6" level, the switch shall be mounted lower in the wainscot as near the 4'-0" level as possible, but in no case, shall the switch be partially in the wainscot and partially in the wall. It shall be the Electrical Contractor's responsibility to verify all door swings. Switches, unless specifically noted, shall be on the strike side of the door. If switch is indicated on hinged side of door, verify location with Architect.

3.5 CONDUCTOR IDENTIFICATION AND INSTALLATION

A. The drawings indicate the arrangement of outlets on each branch circuit and the circuit tags show the number of the circuit, and the board to which it will be connected.

B. Circuits indicated with the same numbers shall be connected to the same breaker on the panelboard.

C. All feeders and branch circuits shall be tagged in all pull boxes and in the gutters of all panels to which they connect.

D. All wiring shall be done in identified neutrals.

E. No wire shall be installed until all work of other contractors that might cause injury to the said wire has been completed. Care shall be used to pull wires to ensure that no damage occurs to the insulation. A wire lubricant shall be used for pulling in wires.

F. In making the connection of all branch circuits to the terminals of switches, base plugs, etc., the wires shall be looped around the binding screws or be fitted with connecting lugs. At the ceiling outlets, this Contractor shall leave not less than 6" of free ends on each wire for connections to the fixtures.

G. No splices shall be permitted except in outlet boxes, and in panelboard gutters.

H. Switches and receptacles shall be securely fastened to the outlet box. Where the outlet box covers are back of the finished walls the switch or receptacle shall be built out from the same with washers so that it is rigidly held in place to the box. The floating of any switch or receptacle will not be permitted.

I. All signal and communications conductors shall be identified in terminal cabinets as to type of system e.g.: clock, bell, fire alarm, etc. and location of other end of conductor by room number or name as directed by Owner. Identification shall be by numbers at terminal strips and a numbered directory in cardholder inside terminal cabinet.

J. Fire alarm system cabling and wiring shall be color-coded as follows:

1) Initiating Devices: Addressable cable, red jacket.

2) Signaling Devices: Black and Red wires for horns, strobes or horn strobes.

3) Speaker cable, blue jacket for speakers.

K. All power wiring size #6 AWG and smaller, shall be factory color-coded. For larger than #6, mark conductors on each end and at all junction and/or pull boxes with a 1" bank of colored pressure-sensitive plastic tape. For isolated ground wires, mark with a 1" band of green tape, followed by a 1" band of yellow tape, followed by a 1" band of green tape. Colors for each phase and the neutral shall be consistent throughout the system. Color code shall be as follows:

L. The white or gray conductor shall be the neutral at each outlet. All switches shall be installed in "hot" leg. On all lighting circuits the switch leg shall be purple from switch to fixture. All travelers from switch to switch on 3 and 4-way switches shall be pink. This color code shall be followed by Contractor for all fixture whips except for factory-manufactured whips. When factory manufactured whips are used, color code shall apply to all wiring except the factory whip.

M. Conductors having white, gray or green covering shall not be used to indicate anything other than neutral or grounding. This limitation applies to all power, lighting, and control circuits.

N. Installation of conductors shall be made in a neat and workmanlike manner to meet Code requirements and shall be run continuous without weld, splice or joint between boxes. Do not install wires in conduit unless the entire system of conduit and outlet boxes is permanently in place. All conductors shall be pulled using a UL approved wire lubricant.

O. Make all terminations at motors using 3M Series 5300 Motor Lead/Cable Splicing Kits. Make connections per 3M written installation procedures.

P. On all bolted electrical connections, the Contractor shall use Belleville washers.

Q. All wiring to be neatly bundled and tied with nylon cord or plastic straps.

R. When approved by the Electrical Engineer, splices in underground pull boxes shall be made with crimp on compression connectors and insulated with heat shrink sleeves or with splice kits listed by the manufacturer for wet locations. Wire nuts are not permitted. Cables and/or conductors for fire alarm and signals systems shall not be spliced.

3.6 GROUNDING

A. The conduit system supports, cabinets, switchboards, etc., and neutral conductors must be permanently and effectively grounded, in accordance with Title 24 of the California Code of Regulations. The neutral shall only be grounded at the main service location unless specifically noted otherwise on the drawings or required by the California Electrical Code.

B. This Contractor shall exercise every precaution to obtain good contacts at all panel boxes, pull boxes, etc.: where it is not possible to obtain good contacts, the conduits shall be bonded around the boxes with a #6 AWG gauge conductor with ground clamps.

C. All equipment cases, motor frames, etc. shall be completely grounded to satisfy applicable code requirements.

D. At each building, the interior hot and cold-water piping and the interior aboveground gas piping shall be bonded to the building service equipment per C.E.C. #250.104.

E. Do not use underground gas piping as a grounding electrode.

F. Pull a green equipment ground conductor in all power conduits, both metallic and non-metallic.

G. Pull a separate isolated ground wire to isolated ground receptacles, insulated green with yellow stripe, in addition to the equipment ground conductor.

H. Isolated ground conductor shall begin at the isolated ground bus in the panel in the building served and shall not be connected to any neutral conductor or any item not isolated from the system ground. All isolated ground circuits shall have a separate neutral conductor (not used for more than one circuit). The isolated ground conductor cannot extend upstream from the building served.

I. Each disconnect switch shall have a ground connector (lay in wire type) which shall be used for grounding the disconnect enclosure. The ground wire shall continue and be connected to the enclosure of the equipment served.

J. Where there is more than one building supplied from a common service, provide a grounding electrode at each building per C.E.C. #250.32.

K. At each telephone backboard and/or data backboard, provide a power distribution block (one pole with two primary openings and six secondary openings) and mount at + 18" A.F.F. unless otherwise noted. Run ¾"C - 1 #6 AWG to the ground bar of the nearest panel or the ground bus of the main switchboard. Power distribution block shall be Square D #LBA 163206 or equal.

3.7 MOUNTING HEIGHTS OF EQUIPMENT

A. A. Unless otherwise specified elsewhere or shown on the plans, the following mounting shall apply:

1) Panelboards: 6'-0" top of box

2) Disconnect Switches: 4'-0" to center line

3) Contactors: 4'-0" to center line

3.8 IDENTIFICATION OF SWITCHES AND APPARATUS

A. All switchboard circuits, externally operated switches and apparatus used for the operation of or control of circuits, appliances, or equipment shall be properly identified with an engraved Bakelite nameplates, 1" x 3", black letters on white background. All such nameplates shall be of the self-adhesive type and attached onto the apparatus by screws or rivets. Card holders in any form are not acceptable.

3.9 EARTHQUAKE PROOFING OF LIGHT FIXTURES

A. Fixtures weighing more than 50 pounds shall be supported independently of the outlet box.

B. Pendant type fixtures shall be designed so that they may swing horizontally in any direction a minimum of 45 degrees from the vertical. Pendant shall have ball aligner at top, and swivel connection at fixture. If there is an obstruction within the 45 swing of the fixture the Contractor shall provide a State approved restraint to keep fixture from swinging into the obstruction.

C. All fixtures mounted in or on suspended ceilings shall be fastened to the ceiling-framing members in accordance with C.E.C. #410.36(B). Recessed fixtures in t-bar ceilings shall be provided with integral t-bar clips, one near each corner to attach it to the t-bar ceiling frame.

D. Recessed fixtures in T-bar ceilings shall be attached to the building structure above with #12 Ga. slack safety wire at two diagonal corners of each fixture (two wires per fixture).

3.10 FIRE RATED AREAS

A. Where light fixtures, conduit, cabinets, or boxes penetrate fire rated ceilings, walls or floors provide a fire rated enclosure or fire stop. Rating of enclosure or fire stop shall match or exceed rating of area penetrated. Verify location of fire rated areas with architectural drawings and with General Contractor.

B. Where outlet boxes are recessed on opposite sides of a fire rated wall, boxes shall be separated by a horizontal distance of at least 24 inches. Where the wall opening for a steel electrical outlet box exceeds 16 sq. inches in area, or an aggregate of more than 100 sq. inches for any 100 sq. feet of wall or partition area, fire stopping is required.

C. C. Penetrations in walls, floors or ceilings requiring protected openings shall be fire-stopped.

D. Fire-stopped shall be of an approved material, securely installed and be in conformance with the 2022 C.B.C, Section 714.3.

E. All required fire-stopping and joint sealants as a result of the work in Divisions 26, 27 and 28 is the responsibility of each individual trade. Refer to Sections 07 8400 and 07 9210, respectively.

3.11 MISCELLANEOUS EQUIPMENT

A. Contractor shall be responsible for electrical hook up and connections to all electrical equipment whether furnished by this Contractor or others, including wiring, conduit, disconnects, circuit breakers etc., even if not shown on drawings. Verify all locations and requirements with equipment supplier before rough-in.

B. When there are fire sprinklers, the Electrical Contractor shall connect bell, flow and tamper switches and other electrical devices as required by Sprinkler Contractor and local and state fire marshal. Verify requirements with General Contractor before bid.

3.12 INTERRUPTION OF SERVICE

A. Interruption of service in existing buildings shall not be made at a time which will inconvenience the Owner. Before making any final connections to the existing buildings or doing any other work that will interrupt the service, the Contractor shall consult with the Owner and schedule the work at Owner's convenience even if it is necessary to make such connections after regular working hours.

B. This Contractor shall do all rerouting and reconnecting of existing electrical facilities made necessary by this construction. Care shall be taken not to disrupt existing facilities. If any facilities are disrupted, this Contractor shall replace or repair them at his expense and to the satisfaction of the Architect.

3.13 CHANGES

A. Electrical Contractor shall consider the number of outlets for electric equipment shown on plans as final, but the Architect reserves the right to shift same, within reason, to a location and position which will meet more completely final requirements.

3.14 GUARANTEE AND TESTS

A. All electrical equipment testing, and related costs shall be included in the Contractor's bid.

B. Contractor shall obtain approval from the Architect of proposed independent testing agencies before any testing is started.

C. Equipment of all kinds installed by this Contractor shall be tested to determine whether it fulfills the requirements of these specifications. The Contractor shall furnish all labor necessary to adjust the operation of the apparatus and make the connections for the tests. After the tests have been completed, the Contractor shall restore all connections, apparatus, etc., to their original condition.

D. Should any piece of apparatus or any material or work fail in any of these tests, it shall be immediately removed and be replaced with new material by this Contractor at his expense and the portion of the work replaced be again tested by the Contractor.

E. All circuit breakers, 100 amps or more, shall be tested by an independent testing agency in accordance with NETA specifications and a report submitted to the Architect. Any circuit breaker that does not pass the test shall be replaced.

F. The entire installation shall be free from short circuits and improper grounds. Panels and circuits shall be tested for grounds and shorts. Each individual circuit shall be tested at the panel with the equipment connected for proper operation. Ground tests shall meet the requirements of the California Electrical Code. Upon completion of the work, a final inspection by the Architect and other interested authorities shall be conducted. This Contractor shall guarantee to repair or replace at his expense any material or equipment that develops defects or is determined not to be in conformance with the plans and specifications, during a period of one year after work is accepted by the Owner.

G. The grounding electrode system at the main electrical service equipment shall be tested by an independent testing agency in accordance with the three-point fall of potential method as specified in IEEE Standard 81-1983. Maximum ground resistance shall be 25 OHMS. A copy of the test report shall be submitted to the Architect and Engineer of record.

H. All feeder cables #2 and larger shall be tested for insulation resistance. Test report must include number of cable per phase & type of cable insulation.

I. Three copies of the test report shall be submitted to the Electrical Engineer prior to the final job walk.

J. The independent testing agency performing the above-mentioned tests shall be NETA or NICET certified or approved by the electrical engineer.

3.15 GROUND FAULT SYSTEMS TEST PROCEDURE (TESTS REQUIRED FOR 480V MAIN DISCONNECT)

A. Visual and Mechanical Inspection: VISUAL AND MECHANICAL INSPECTION:

1) Inspect for physical damage and compliance with plans and specifications.

2) Inspect neutral main bonding connection to assure:

a) Zero sequence sensing system is grounded.
b) Ground strap sensing systems are grounded through sensing device.
c) Ground connection is made ahead of neutral disconnect link on zero sequence sensing system.
d) Grounded conductor (neutral) is solidly grounded.

3) Inspect control power transformer to ensure adequate capacity for system.

4) Monitor panels (if present) shall be manually operated for:

a) Trip test
b) No trip test
c) Non-automatic reset

5) Proper operation and test sequence shall be recorded.

6) Inspect zero sequence systems for symmetrical alignment of core balance transformers about all current carrying conductors.

7) Verify ground fault device circuit nameplate identification by device operation.

8) Set pickup and time delay settings in accordance with the project Electrical Engineer's provided settings.

3.16 ELECTRICAL TESTS

A. Measure system neutral insulation resistance to ensure no shunt ground paths exist. Remove neutral-ground disconnect link. Measure neutral insulation resistance and replace link.

B. Determine the relay pickup current by primary injection at the sensor and operate the circuit-interrupting device.

C. Test the relay timing by injecting one hundred fifty percent (150%) and three hundred percent (300%) of pickup current, or as specified by manufacturer.

D. Test the system operation at fifty-seven percent (57%) rated voltage.

E. Test zone interlock systems by simultaneous sensor current injection and monitoring zone blocking function.

3.17 TEST PARAMETERS

A. System neutral insulation shall be a minimum of one hundred (100) ohms.

B. Relay pickup current shall be set to a value between 20% and 25% of the rating of the main circuit breaker. The setting shall be the in-service setting unless otherwise specified.

C. Relay time delay shall be the closest possible calibrated setting to .1 seconds. This shall be the in-service setting unless otherwise specified.

3.18 DEMOLITION

A. Remove and/or relocate electrical facilities as required to clear areas for new construction.

END OF SECTION

SECTION 270200
COMMUNICATIONS GENERAL REQUIREMENTS (STRUCTURED CABLING SYSTEMS AND PATHWAYS AND SPACES SYSTEMS FOR ALL VOICE AND DATA SYSTEMS)

PART 1 GENERAL

1.1 SUMMARY

A. The Scope of Work covered by this document is to furnish and install the Structured Cabling Systems and Pathways and Spaces systems. This work will provide the structured cabling system (SCS) for all Voice and Data systems.

B. Telecommunications system shall include the following systems:

1) Structured Cabling System (SCS) For Telecommunications Systems

2) Pathways for Telecommunications Systems

3) Grounding and Bonding System (GBS) For Telecommunications Systems

4) Fire stopping for Telecommunications Systems

1.2 ADDITIONAL REQUIREMENTS

A. Coordination of work: Contractor shall be responsible for coordination of work among project specification divisions and contractor/subcontractors involved in this project. This coordination of Work Includes following instructions provided the Construction Manager or General Contractor if project is managed by such.

B. General compliance requirements: Provide a complete and operable system in compliance with project drawings, specifications, referenced standards, applicable building codes, and Authority Having Jurisdiction (AHJ) requirements. Scope of this contract includes materials, equipment, labor, configuration, programming, testing, startup and commissioning services, and documentation costs for complete and operable system that meets all requirements indicated on drawings or contained in specifications. Comply with all contract documents, specifications, drawings, manufacturer's instructions, and Owner and AHJ requirements. In case of conflict among applicable documents or standards, the contractor shall notify owner's representative in writing of apparent conflict, and then comply with most stringent requirements unless otherwise directed in writing from owner's representative. Work includes all items required for complete system whether or not identified in specification or drawings.

C. Information about general construction and architectural features and finishes shall be derived from structural and architectural drawings and specifications only.

D. Work related to telecommunications systems shall be installed by an SCS manufacturers authorized or certified trained installer. The owner reserves the right to review and approve any personnel assigned to this project in a supervisory or managerial role.

E. SCS contractor shall have had at least 3 years of comparable experience with telecommunications projects. Comparable projects shall equal or exceed the size and complexity of work on drawings.

F. Complete and usable work: Refer to and comply with requirements in section 27 02 67 outlined below.

1.3 RELATED DOCUMENTS AND DRAWINGS

A. General: The project drawings and general conditions of Contract shall apply to this section.

B. Coordination: Coordinate with work specified in other sections and divisions of specifications.

C. Reference: Codes and standards as referenced in Section 27 02 20 may define additional specifications or requirements not specifically called out within this division. However, the contractor shall adhere to most stringent requirements as defined herein, or as defined by reference within section 27 02 20.

D. Architectural and Engineering specifications may have additional conditions or requirements that affect the work defined by this division of specifications. Contractor shall be responsible for the coordination of all conditions and other trade requirements that may impact schedule, scope of work, work progress, or other factors that may affect the overall ability for contractor to execute the requirements of this division of specifications.

1.4 CODES AND STANDARDS

A. General: All work, including but not limited to: cabling, pathways, support structures, wiring, equipment, installation and workmanship shall comply with the latest editions of the requirements of the Authority Having Jurisdiction (AHJ), California Electrical Code, all applicable local rules and regulations, equipment manufacturer's instructions, and the National Electrical Contractor's Association (NECA) Standard of Installation. In case of discrepancy or disagreement between the documents noted above, the Contractor shall satisfy the most stringent requirements.

B. Other sections of this document contain References to Codes and Standards that are applicable to the section.

1.5 CODES

A. California Electric Code (((CEC)))

1.6 REFERENCE STANDARDS

A. Telecommunications Industry Association (TIA)

1) TIA-526-7, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7

2) T-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – SFSTP-14

3) TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises

4) TIA-568-C.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements

5) TIA-568-C.2, Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted Pair Cabling Components

6) TIA-568-C.3, Optical Fiber Cabling Components Standard

7) TIA-569-B, Commercial Building Standards for Telecommunications Pathways and Spaces

8) TIA-606, Administration Standard for Commercial Telecommunications Infrastructures

9) ANSI J-STD-607-A, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

B. Other Reference Materials

1) BICSI Telecommunications Distribution Methods Manual (TDMM)

2) BICSI Wireless Design Reference Manual (WDRM)

3) Institute of Electrical and Electronic Engineers (IEEE)

4) National Electrical Manufacturers Association (NEMA)

5) Underwriters Laboratories (UL) Cable Certification and Follow Up Program

1.7 DEFINITIONS

A. Access Floor - A floor system that has removable floor panels.

B. Building Backbone Cabling – Cabling used to connect Floor Distributors (FD) or other local collection points to the Building Distributor (BD). Building backbone cabling typically carries aggregate traffic and, as such, impacts multiple network devices and users. Building backbone cabling may include either fiber optic or copper cabling or both.

C. Building Distributor (BD) – Termination points from which all building backbone cabling emanates and interconnection point for the network backbone. Commonly referred to as BDF and Intermediate Cross-connect (IC). There is one BD for each building, and it feeds all FD's in the same building. The BD should be located so that all FD's served are within 300 cable meters (984 cable feet).

D. Campus Backbone Cabling – Cabling used to connect Building Distributors (BD) or other key network segments to the Campus Distributor (CD). With rare exceptions, campus backbone cabling carries aggregate traffic and typically impacts entire buildings worth of network devices and users and, as such, link redundancy with diverse routing is highly recommended. Campus backbone cabling almost exclusively consists of fiber optic cabling. Copper cabling may be used in short-distance (< 90m) applications. In such cases, lightning protection will usually be required by code.

E. Campus Distributor (CD) – Termination point from which all campus backbone cabling emanates and highest-level interconnection point for the network backbone. Commonly referred to as NOC and Main Cross-connect (MC). On smaller campuses, there is one CD for the campus. On larger campuses there might be several CD's with each CD serving several buildings. Besides linking to each of the BD's it serves, the CD is also the network interconnection point for data center links and links to service providers.

F. Category 6 (Cat 6) / Class E – A category/class of transmission performance that specifies electrical properties up to 250 MHz. Refer to the TIA/EIA 568B family of standards for more information on Category 6 and ISO/IEC 11801 for more information on Class E requirements. Also refer to CENELEC EN50173.

G. Category 6A (Cat 6) / Class EA– A category/class of transmission performance that specifies electrical properties up to 500 MHz and capable of supporting data applications operating at 10Gbps. Refer to the TIA/EIA 568B family of standards for more information on Category 6 and ISO/IEC 11801 for more information on Class EA requirements.

H. Certification – The testing and documentation of the transmission performance (e.g., Category 5e / Class D) of a permanent link or channel, based on sweep frequency (where applicable) testing of

numerous parameters with results compared to a range of acceptable values. This project requires 100% certification (with documentation) of all permanent link cabling at the time of installation. Channel certification is optional and is the responsibility of the group using the channel.

I. Channel – The entire physical pathway between active equipment ports, inclusive of all patch cords, patch panels, jacks and cabling segments.

J. Conduit - A raceway of circular cross-section.

K. Entrance Facility (EF) – Termination points of service provider cables that have entered the building and location of service demarcation point (MPOE) and interconnection point to the network. Commonly referred to as Telco Room and Entrance Facility (EF). The EF is linked to the CD, where present, or to the BD.

L. Floor Distributor (FD) – Termination points for horizontal cabling and interconnection point for network access. Commonly referred to as IDF and Horizontal Cross-connect (HC) - FD quantities and locations are determined by building size and geometry so that all points served are within 90 cable meters (295 cable feet) of an FD. The FD feeds all Telecommunications Outlets (TO's) in its service zone. All FD's in a building are linked to the building's Building Distributor (BD) via backbone cabling.

M. Horizontal Cabling – Cabling used to connect individual work area outlets to local Floor Distributors (FD) or other collection points. Unlike backbone cabling, horizontal cabling does not typically carry aggregate traffic and, as such, impacts only single network devices or users. In buildings, horizontal cabling almost exclusively consists of copper cabling. Fiber optic cabling may be used where situations dictate but, unlike horizontal copper cabling, horizontal fiber optic cabling is not installed in advance as default building facilities. At this writing, horizontal copper cabling in many networks is capable of supporting Gigabit (1Gb/s) Ethernet applications as well as other applications of similar bandwidth.

N. Permanent Link – A stationary cabling segment, consisting of the permanently installed cable and the permanently affixed jack at both ends (typically at the outlet faceplate and closet patch panel, or on a patch panel on both ends). The concept assumes that, while patch cords might be disconnected or moved over time, the permanent cable and jacks will not be disturbed, and the electrical characteristics of the permanent link will remain unaltered.

O. Plenum -A space within the building designed for the movement of environmental air, i.e., a space above a suspended ceiling or below an access floor.

P. Raceway - Any channel designed for holding wires or cables, i.e. conduit, electrical metal tubing, busways, wireways, ventilated flexible cableway.

1.8 PROJECT DRAWINGS

A. Building composite floor plans: Provide building floor plans showing outlet locations and jack configuration, types of jacks, run distance for each jack cable, and cable routing/locations. Identify TO's that, according to location and available pathway systems, require cable length greater than allowed by standards. Recommend alternatives for Owners Representative's consideration.

B. Telecommunications space plans/elevations: Include enlarged floor plans of TRs indicating layout of equipment and devices, including receptacles and grounding provisions. Submit detailed plan views and elevations of telecommunications spaces showing racks, termination blocks, and cable paths.

C. Logical Drawings: Provide logical riser or schematic drawings for all systems. Include schematic symbol key.

1.9 SUBSTITUTIONS

A. Substitution requests: Substitution requests will be considered only if submitted to Owner's Representative not less than 7 working days prior to project bid date. Acceptance or rejection of proposed substitution is at Owner's Representatives sole discretion. No exceptions. Requests for substitutions shall be considered not approved unless approval is issued in writing by Owner's Representative.

B. Rejection: For equipment, cabling, wiring, materials, and all other products indicated or specified as no substitutions or no alternates, Owner does not expect nor desire requests for substitutions and alternate products other than those specified. Owner reserves right for Owner's Representative to reject proposed substitution requests and submissions of alternates without review or justification.

1.10 WARRANTY

1.11 CONTRACTORS WARRANTY

A. General requirements: Comply with additional requirements in the contract general requirements and extended warranties required in other specification sections. Refer to all other 27xxx sections for specific additional warranty requirements that exceed or are in addition to those of this section.

B. Contractor warranty: Provide all services, materials, and equipment necessary for successful operation of entire telecommunications system and SCS system for a period of one year after system acceptance. Scope of warranty includes all equipment, devices, wiring, accessories, software, hardware, installation, programming, and configuration required to maintain a complete and operable system. Provide manufacturer's published recommended preventative maintenance procedures during warranty period. This shall apply to all items except those specifically excluded, or items wherein a longer period of service and warranty is specified or indicated. All warranties shall be in effect for one year, minimum, from the date Certificate of Final Acceptance is issued. Use of systems provided under this section for temporary services and facilities shall not constitute final acceptance of work nor beneficial use by Owner and shall not institute warranty period. The warranty shall cover repair or replacement of defective materials, equipment, workmanship, and installation that may be incurred during this period. Warranty work is to be done promptly and to Owner's satisfaction. In addition, the warranty shall cover correction of damage caused in making necessary repairs and replacements under warranty. Additional warranty responsibilities are:

1) Obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's designated name. Replace material and equipment that require excessive service during guarantee period as determined by Owner.

2) Provide 2-business day service beginning on date of Substantial Completion and lasting until termination of warranty period. Service shall be at no cost to Owner. Service can be provided by installing contractor or by a separate service organization. Choice of service organization shall be subject to Owner's approval. Submit name and a phone number that will be answered on a 24-hour basis each day of week, for duration of service.

3) Submit copies of equipment and material warranties to Owner before final acceptance.

4) At end of warranty period, transfer manufacturers' equipment and material warranties still in force to Owner.

5) If warranty work problems cannot be corrected immediately to Owner's satisfaction, advise Owner in writing, describing efforts to correct situation, and provide analysis of cause for problem. If necessary to resolve problems, provide at no cost services of manufacturer's

engineering and technical staff at site in a timely manner to analyze warranty issues, and develop recommendations for correction, for review and approval by Owner.

C. Pathways Material and Installation warranty: Provide all services, materials, and equipment necessary to warrant the installation and performance of all pathway materials for a period of one year after beneficial use. The scope of the warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.

D. Grounding and Bonding Material and Installation warranty: Provide all services, materials and equipment necessary for successful operation of GBS for a period of one year after beneficial use. The scope of the warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.

E. Firestopping Material and Installation warranty: Provide all services, materials, and equipment necessary to warrant the performance of all Firestopping material for a period of one year after beneficial use, or longer if required by the local AHJ. The scope of warranty includes all equipment, devices, installation, and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.

1.12 SCS MANUFACTURERS EXTENDED WARRANTY

A. SCS Systems will be covered by a two-part certification program provided by a single manufacturer and that manufacturer's certified vendor. Manufacturer shall administer a follow-up program through the Vendor to provide support and service to the purchaser. The first part is an assurance program, which provides that the certified system will support the applications for which it is designed, during the 20-year warranty of the certified system.

B. The second portion of the certification is a 20-year warranty provided by the manufacturer and the vendor on all products within the system (cords, telecommunications outlet/connectors, cables, cross-connects, patch panels, etc.).

C. In the event that the certified system ceases to support the certified application(s), whether at the time of cutover, during normal use or when upgrading, the manufacturer and vendor shall commit to promptly implement corrective action.

D. The cabling system must conform to the current issue of industry standard ANSI/TIA/EIA-568. All performance requirements of this document must be followed. As well, workmanship and installation methods used shall be equal to or better than that found in the BICSI (Building Industry Consulting Service International) ITSIM manual.

1.13 COMPLETENESS OF WORK

A. Complete and usable work: The contractor is responsible for providing complete and usable work according to contract documents. All materials and equipment shall be provided with all accessories and additional work required for field conditions, as well as additional work and accessories required for complete, usable, and fully functional construction and systems, even if not explicitly specified or indicated. Telecommunications system in this Contract shall be provided as complete and operable systems in full compliance with requirements on drawings and specification requirements. Drawings are diagrammatic and specifications are performance-based, and Contractor shall provide all work required to comply with drawings and specifications, even if not explicitly indicated or specified. The contractor shall be responsible for coordinating the installation of electrical systems with all field

conditions and the work of other trades. Minimum clearances and work required for compliance with, California Electrical Code (((CEC))), and manufacturer's instructions shall be provided. Comply with additional requirements indicated for access and clearances. Contractor shall verify all field conditions and dimensions that affect selection and provision of materials and equipment, and shall provide any disassembly, reassembly, relocation, demolition, cutting, and patching required to provide work specified or indicated, including relocation and reinstallation of existing wiring and equipment. Contractor shall protect from damage resulting from Contractor's operations existing facility, equipment, and wiring. Extra charges for completion and contract time extension will not be allowed because of field conditions or additional work required for complete and usable construction and systems. Comply with additional requirements indicated for access and clearances.

B. Drawings and specifications form complementary requirements; provide work specified and not shown, and work shown and not specified as though explicitly required by both. Except where explicitly modified by a specific notation to contrary, it shall be understood that indication or description of any item, in drawings or specifications or both, carries with it instruction to furnish and install item, provided complete.

C. Terms: As used in this specification, provide means furnish and install. Furnish means "to purchase and deliver to project site complete with every necessary appurtenance and support," and install means "to unload at delivery point at site and perform every operation necessary to establish secure mounting and correct operation at proper location in project."

D. Supplementary items: Provide supplementary or miscellaneous items, appurtenances, devices and materials necessary for a sound, secure and complete installation. Examine project drawings and other Sections of specifications for requirements that affect work of this section. Completely coordinate the work of this section with the work of other Sections and provide a complete and fully functional installation. Refer to all other drawings and other specifications sections that indicate types of construction in which work shall be installed and work of other sections with which work of this section must be coordinated.

1.14 PROJECT CONDITIONS

A. Field verification: Carefully verify location, use and status of all material, equipment, and utilities that are specified, indicated, or deemed necessary for removal. Verify that all materials, equipment, and utilities to be removed are completely inactive and will not be required or in use after completion of project. Replace with equivalent any material, equipment and utilities that were removed by Contractor that are required to be left in place.

B. Existing utilities: As applicable, do not interrupt utilities serving facilities occupied by Owner or others unless permitted under following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1) Notify owner in writing at least 14 days in advance of proposed utility interruptions. Do not proceed with utility interruptions without Owner's written permission.

2) Equipment installation:

a) Determine suitable path for moving unit substation into place; consider Project conditions.
b) Verify clearance requirements and locate equipment to meet installation tolerances.
c) Revise locations and elevations from those indicated to those required to suit Project.

1.15 DELIVERY STORAGE AND HANDLING

A. General: Contractor shall be responsible for the deliveries, storing and handling of all materials related to the SCS systems, including materials supplied by others that are part of the SCS installation contract. Material shall be stored and protected according to the manufacturer's instructions. The contractor shall be responsible for the security of all material during installation. For all material provided by contractor, or delivered to contractor on site, contractor assumes full responsibility and liability for any material shortages, damage, or loss due to storage and handling methods.

1.16 EXAMINATION

A. General: Prior to submitting a proposal, Contractor shall examine site, review Project drawings and specifications, and determine exact extent of work required. Contractors shall include in their proposals all materials, labor, and equipment required to complete the required work indicated. Work that is necessary to obtain complete and usable Project as specified herein shall be included in Contractor's proposal, even if not indicated or specified.

B. Bidders' questions: Should bidders have questions as to intent of drawings and specifications, quality of materials to be used, and work to be performed, questions shall be submitted in writing to Owner's Representative in manner dictated by Owner's Representative. All answers and clarifications to drawings and specifications will be issued in writing.

C. Extra payment will not be allowed for claims due to unfamiliarity with work to be performed by other trades, existing conditions at job site, local or state laws and codes, and alterations due to field conditions.

1.17 ADDITIONAL COSTS

A. General: Project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing/demonstrations shall be conducted after verification of system operation and completeness by Contractor.

B. Inspections and testing: For Project acceptance inspections, final completion inspections, substantial completion inspections, and/or testing/demonstrations that require more than one site visit by Owner's Representative or Architect/Engineer to verify Project compliance for same material or equipment, Owner reserves right to obtain compensation from Contractor to defray cost of additional site visits that result from Project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions. Owner's Representative will notify Contractor of hourly rates and travel expenses for additional site visits and will issue an invoice to Contractor for additional site visits. Payment of additional site visit costs by Contractor is required within 30 days of invoicing. The owner reserves the right to deduct additional costs defined herein that are indicated on past due invoices from Project amount due Contractor.

C. Exclusions: Contractor shall not be eligible for extensions of Project schedule or additional charges resulting from additional site visits that result from Project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.

END OF SECTION

SECTION 270400
SYSTEM EXECUTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. General: Sequence, coordinate, and integrate various elements of telecommunications system, materials, and equipment. Comply with following requirements as a minimum.

B. Coordinate systems, equipment, and materials installation with other building components.

C. Verify all dimensions by field measurements.

D. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for wiring, cabling, and equipment installations.

E. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

F. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work. Give particular attention to large equipment requiring positioning prior to closing in building.

G. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom and access for service and maintenance as possible.

H. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

I. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by Contract Documents, recognizing that portions of Work are shown only in diagrammatic form. In case of conflict among individual system requirements, request direction in writing from Owner’s Representative.

J. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components, where installed in both exposed and un-exposed spaces.

K. Install cabling, wiring, and equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

L. Provide access panel or doors where units are concealed behind finished surfaces.

M. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

N. Comply with all requirements and work indicated on drawings.

O. Avoid interference with structure and with work or other trades, preserving adequate headroom and clearing doors and passageways to satisfaction of Owner and according to code requirements.

P. Install equipment and cabling/wiring so as to properly distribute equipment loads on building structural members provided for equipment support under other Sections. Roof-mounted equipment shall be installed and supported on structural steel or roof curbs as appropriate.

Q. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs as necessary for floor, wall and ceiling mounting of equipment as required.

R. Provide steel supports and hardware for proper installation of hangers, anchors, guides, and other support hardware.

S. Obtain and analyze catalog data, weights, and other pertinent data required for proper coordination of equipment support provisions and installation.

T. Structural steel and hardware shall conform to ASTM standard specifications. Use of steel and hardware shall conform to requirements of AISC Code of Practice: Section Five.

U. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly that would void warranty.

PART 2 EQUIPMENT

2.1 2.01 EQUIPMENT INSTALLATION

A. General: Install equipment according to manufacturer's written instructions. Install equipment level and plumb. Install wiring and cabling between equipment and all related devices.

B. Mounting: If neither the Owner's Instructions nor the individual section call out the required hardware mounting, use the following.

1) For equipment at walls, bolt units to wall or mount on structural steel channel strut bolted to wall.

2) For equipment not at walls, provide freestanding racks fabricated of structural steel members and slotted structural steel channel strut.

3) Use feet consisting of 0.25-inch-thick steel plates, 6 sq inch (836127.36 sq mm), bolted to floor.

4) Use feet for welded attachment of vertical posts not over 3 feet (91.44 cm) on center.

5) Connect posts with horizontal U channel steel strut and bolt control equipment to channels.

C. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally using methods and materials as recommended by manufacturer.

D. Connections: Tighten wiring connectors, terminals, bus joints, and mountings, to include lugs, screws, and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. In absence of published connection or terminal torque values, comply with torque values specified in UL 486A and UL 486B.

PART 3 EXECUTION

3.1 DEMOLITION, REMOVAL, AND PROTECTION OF WORK

A. Demolition and removal: Cut, remove, and legally dispose of selected equipment, components, and materials as indicated, including but not limited to removal of material, equipment, devices, and other items indicated to be removed and items made obsolete by new Work. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.

B. Protection of work: Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed. During cutting and patching operations, protect adjacent installations. Patch

finished surfaces and building components using new materials specified for original installation and experienced Installers.

3.2 PENETRATIONS AND SLEEVES

A. General: Coordinate work with other sections. SCS Installation Contractor shall be responsible for the provision of cabling sleeves and conduits unless specifically provided by the Electrical Contractor. SCS Installation Contractor shall coordinate with Electrical Contractor to determine exact requirements.

B. When required, set sleeves in forms before concrete is poured. Provide core drilling as necessary if walls are poured or otherwise constructed without sleeves and wall penetration is required. Do not penetrate structural members. Provide sleeves and packing materials at all penetrations of foundations, walls, slabs (except on-grade), partitions, and floors. Sleeves shall meet requirements of pertinent specifications. Lay out penetration and sleeve openings in advance, to permit provision in work. Set sleeves and conduit in forms before concrete is poured. Provide remedial work where sleeves and conduits are omitted or improperly placed.

C. Sleeve fill: Sleeves that penetrate outside walls, basement slabs, footings, and beams shall be waterproof.

1) Fill slots, sleeves and other openings in floors or walls if not used.

2) Fill spaces in openings after installation of conduit or cable.

3) Fill for floor penetrations shall prevent passage of water, smoke, fire, and fumes.

4) Fill shall be fire resistant in fire floors and walls, and shall prevent passage of air, smoke, and fumes. See section 27 05 32 - Firestopping for Telecommunications Systems.

5) Sleeves through floors shall be watertight and shall extend 2 inches (50.8 mm) above floor surface.

6) Where raceways passing through openings are exposed in finished rooms, finishes of filling materials shall match and be flush with adjoining floor, ceiling, and wall finishes.

D. Conduit sleeves:

1) Annular space between conduit and sleeve shall be at least 1/4 inch (6.35 mm).

2) Sleeves shall not be provided for slabs-on-grade unless specified or indicated otherwise.

3) For sleeves through rated fire walls and smoke partitions, comply with requirements for firestopping. See section 27 05 32 - Firestopping for Telecommunications Systems.

E. Supports: Do not support piping risers or conduit on sleeves.

F. Future use: Identify unused sleeves and slots for future installation.

3.3 CLEANING

A. Contractor is responsible for clean up of debris on a daily basis. Cost of clean up is the responsibility of the Contractor.

B. During progress of work, remove equipment and unused material. Put building and premises in neat and clean condition. Perform cleaning and washing required to provide acceptable appearance and operation of equipment to satisfaction of Owner’s Representative.

C. After completion of Project, clean exterior surface of all equipment, including concrete residue, dirt, and paint residue. Final cleaning shall be performed prior to Project acceptance by Owner's Representative.

3.4 SPECIAL RESPONSIBILITIES AND INFORMATION

A. Coordination of information: Cooperate and coordinate with work of other sections in executing work of this section. Perform work such that progress of entire project, including work of other sections, shall not be interfered with or delayed. Provide information as requested on items furnished under this section, which shall be installed under other sections. Obtain detailed installation information from manufacturers of equipment provided under this section.

B. Information gathering: Obtain final rough-in dimensions or other information as needed for complete installation of items furnished under other sections or by Owner. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under this and other sections. Give full information so that openings required by work of this section may be coordinated with other work and other openings and may be provided for in advance. In case of failure to provide sufficient information in proper time, provide cutting and patching or have same done, at no expense to Owner.

C. Housekeeping pads: Provide information as requested as to sizes, number, and locations of concrete housekeeping pads necessary for floor mounted equipment.

D. Maintenance of equipment and systems: Maintain equipment and systems until Final Acceptance. Ensure adequate protection of equipment and material during delivery, storage, installation, and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

E. Use of premises: Use of premises shall be restricted as directed by Owner's Representative and as required below:

1) Cleaning and rubbish removal: Remove and dispose of dirt and debris, and keep premises clean. During progress of work, remove equipment and unused material. Put building and premises in neat and clean condition, and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of Owner's Representative.

2) Rubbish Removal: Provide for the removal from the site of all spoils, debris, boxes, packaging, crates, and trash generated from the work.

3) Storage: Store materials maintaining an orderly, clean appearance. If stored on site in open or unprotected areas, all equipment and material shall be kept off ground by means of pallets or racks, and covered with tarpaulins.

F. Protection of fireproofing:

1) Clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed shall be installed, if possible, prior to start of spray fire proofing work.

2) Conduits and other items that would interfere with proper application of fireproofing shall be installed after completion of spray fire proofing work.

3) Patching and repairing of fireproofing due to cutting or damaging to fireproofing during course of work specified under this section shall be performed by installer of fireproofing and paid for by section responsible for damage and shall not constitute grounds for an extra to Owner.

4) Temporary utilities: Refer to contract general requirements regarding requirements.

5) Movement of materials: Unload materials and equipment delivered to site. Pay costs for rigging, hoisting, lowering and moving equipment on and around site, in building or on roof.

3.5 DIVISION OF WORK

A. General: Division of work responsibility matrix at the end of this section is for Contractor's reference to clarify roles of various manufacturers, installers, subcontractors, and trades involved in telecommunications system Project.

B. Contractor holding contract with Owner is responsible for coordinating work of all subcontractors to provide a complete and usable Project complying with contract provisions of Project documents.

C. Failure to coordinate work by subcontractors and suppliers will not be considered justification for additional compensation or extension of schedule.

END OF SECTION

SECTION 270500
– COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 – GENERAL

1.01 1.1 RELATED DOCUMENTS

DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 1 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

1.2 SUMMARY

THIS SECTION INCLUDES THE MINIMUM REQUIREMENTS FOR THE EQUIPMENT AND CABLE INSTALLATIONS IN COMMUNICATIONS EQUIPMENT ROOMS (TELECOMMUNICATIONS CLOSETS), INCLUDING GROUNDING ELECTRODE SYSTEMS, BUSBARS, BONDING ACCESSORIES, AND RELATED COMPONENTS.

1.3 QUALITY ASSURANCE

ALL CABLE AND EQUIPMENT SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER. METHODS NOT SPECIFICALLY DESCRIBED OR INDICATED SHALL BE SUBJECT TO THE CONTROL AND APPROVAL OF THE OWNER OR OWNER'S REPRESENTATIVE. EQUIPMENT AND MATERIALS SHALL BE OF THE QUALITY AND MANUFACTURE INDICATED. 'APPROVED EQUAL' ITEMS SHALL BE EQUIVALENT IN EVERY WAY TO THE SPECIFIED EQUIPMENT AND SUBJECT TO APPROVAL.

1.4 SUBMITTALS

SUBMIT PRODUCT DATA FOR ALL PRODUCTS, INCLUDING MANUFACTURERS' CUT SHEETS, SPECIFICATIONS, AND INSTALLATION INSTRUCTIONS.

PART 2 – PRODUCTS

9.01 2.X GROUNDING ELECTRODE SYSTEM

BUSBARS

ACTIVE GROUNDING SYSTEM CONSTANTLY REPLENISHING MOISTURE INTO THE SOIL

PROVIDE LOW RESISTANCE TO GROUND

PROVIDE SEASON TO SEASON STABILITY

BE MAINTENANCE-FREE FOR 30 YEARS

CONTAIN NO HAZARDOUS MATERIALS OR CHEMICALS.

APPROVED MANUFACTURERS:

COOPER BLINE, BURNDY, OR APPROVED EQUAL.

2.X WALL-MOUNT BUSBARS

TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB) SHALL BE CONSTRUCTED OF .25" (6.4 MM) THICK SOLID COPPER BAR.

THE BUSBAR SHALL BE 4" (100 MM) HIGH AND 20" (510 MM) LONG AND SHALL HAVE 30 ATTACHMENT POINTS (TWO ROWS OF 15 EACH) FOR TWO-HOLE GROUNDING LUGS.

THE HOLE PATTERN FOR ATTACHING GROUNDING LUGS SHALL MEET THE REQUIREMENTS OF -J- – 607-A AND SHALL ACCEPT 27 LUGS WITH 5/8" (15.8 MM) HOLE CENTERS AND 3 LUGS WITH 1" (25.4) MM) HOLE CENTERS.

THE BUSBAR SHALL INCLUDE WALL-MOUNT STAND-OFF BRACKETS, ASSEMBLY SCREWS AND INSULATORS CREATING A 4" (100 MM) STANDOFF FROM THE WALL.

THE BUSBAR SHALL BE UL LISTED AS GROUNDING AND BONDING EQUIPMENT.

APPROVED MANUFACTURES:

CHATSWORTH (), ERICO CADDY, COOPER BLINE, OR APPROVED EQUAL

TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

TELECOMMUNICATIONS GROUNDING BUSBAR (TGB) SHALL BE CONSTRUCTED OF .25" (6.4 MM) THICK SOLID COPPER BAR.

THE BUSBAR SHALL BE 2" (50 MM) HIGH AND 12" (300 MM) LONG AND SHALL HAVE 9 ATTACHMENT POINTS (ONE ROW) FOR TWO-HOLE GROUNDING LUGS.

THE HOLE PATTERN FOR ATTACHING GROUNDING LUGS SHALL MEET THE REQUIREMENTS OF -J- – 607-A AND SHALL ACCEPT 6 LUGS WITH 5/8" (15.8 MM) HOLE CENTERS AND 3 LUGS WITH 1" (25.4 MM) HOLE CENTERS.

THE BUSBAR SHALL INCLUDE WALL-MOUNT STAND-OFF BRACKETS, ASSEMBLY SCREWS AND INSULATORS CREATING A 4" (100 MM) STANDOFF FROM THE WALL.

THE BUSBAR SHALL BE UL LISTED AS GROUNDING AND BONDING EQUIPMENT.

APPROVED MANUFACTURES:

CHATSWORTH (), ERICO CADDY, COOPER BLINE, OR APPROVED EQUAL

ATTACH BUSBARS TO THE WALL WITH APPROPRIATE HARDWARE ACCORDING TO THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.

CONDUCTOR CONNECTIONS TO THE TMGB OR TGB SHALL BE MADE WITH TWO-HOLE BOLT-ON COMPRESSION LUGS SIZED TO FIT THE BUSBAR AND THE CONDUCTORS.

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.

THE WALL-MOUNT BUSBAR SHALL BE BONDED TO GROUND AS PART OF THE OVERALL TELECOMMUNICATIONS BONDING AND GROUNDING SYSTEM.

RACK-MOUNT BUSBARS AND GROUND BARS

WHEN A RACK OR CABINET SUPPORTS ACTIVE EQUIPMENT OR ANY TYPE OF SHIELDED CABLE OR CABLE TERMINATION DEVICE REQUIRING A GROUND CONNECTION, ADD A RACK-MOUNT HORIZONTAL OR VERTICAL BUSBAR OR GROUND BAR TO THE RACK OR CABINET. THE RACK-MOUNT BUSBAR OR GROUND BAR PROVIDES MULTIPLE BONDING POINTS ON THE RACK FOR RACK AND RACK-MOUNT EQUIPMENT.

ATTACH RACK-MOUNT BUSBARS AND GROUND BARS TO RACKS OR CABINETS ACCORDING TO THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.

BOND THE RACK-MOUNT BUSBAR OR GROUND BAR TO THE ROOM'S TMGB OR TGB WITH APPROPRIATELY SIZED HARDWARE AND CONDUCTOR.

GROUND TERMINAL BLOCK

EVERY RACK AND CABINET SHALL BE BONDED TO THE TMGB OR TGB.

MINIMUM BONDING CONNECTION TO RACKS AND CABINETS SHALL BE MADE WITH A RACK-MOUNT TWO-HOLE GROUND TERMINAL BLOCK SIZED TO FIT THE CONDUCTOR AND RACK AND INSTALLED ACCORDING TO MANUFACTURER RECOMMENDATIONS.

REMOVE PAINT BETWEEN RACK/CABINET AND TERMINAL BLOCK, CLEAN SURFACE AND USE ANTIOXIDANT BETWEEN THE RACK AND THE TERMINAL BLOCK TO HELP PREVENT CORROSION AT THE BOND.

PIPE CLAMP

BOND METAL PIPES LOCATED INSIDE THE DATA CENTER COMPUTER ROOM WITH A MINIMUM #6 AWG CONDUCTOR TO THE TMGB OR TGB USING A PIPE CLAMP SIZED TO FIT THE PIPE AND THE CONDUCTOR AND INSTALLED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS.

REMOVE PAINT BETWEEN THE PIPE AND PIPE CLAMP, CLEAN SURFACE AND USE ANTIOXIDANT BETWEEN THE PIPE AND THE CLAMP TO HELP PREVENT CORROSION AT THE BOND.

REMOVE INSULATION FROM CONDUCTORS WHERE WIRES ATTACH TO THE PIPE CLAMP.

EQUIPMENT GROUND JUMPER KIT

BOND EQUIPMENT TO A VERTICAL RACK-MOUNT BUSBAR OR GROUNDBAR USING GROUND JUMPER ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS.

CLEAN THE SURFACE AND USE ANTIOXIDANT BETWEEN THE COMPRESSION LUGS ON THE JUMPER AND THE RACK-MOUNT BUSBAR OR GROUNDBAR TO HELP PREVENT CORROSION AT THE BOND.

PATHWAYS FOR COMMUNICATIONS SYSTEMS

GENERAL

SCOPE OF WORK

INSTALL EMPTY RACEWAY SYSTEM, INCLUDING UNDERFLOOR AND OVERHEAD DISTRIBUTION SYSTEM, FISH WIRE, TERMINAL CABINETS, OUTLET BOXES, FLOOR BOXES, PULL BOXES, COVER PLATES, CONDUIT, SLEEVES AND CAPS, CABLE TROUGHS, SERVICE POLES, MISCELLANEOUS AND POSITIONING MATERIAL TO CONSTITUTE COMPLETE SYSTEM, AS INDICATED FOR DISTRIBUTION OF TELECOMMUNICATIONS WIRING WHICH INCLUDES CABLES FOR DATA, VOICE, VIDEO, AUDIO, SECURITY, AND FUTURE SIGNAL REQUIREMENTS.

THE LOCATION AT WHICH ALL NEW TELECOMMUNICATIONS WIRING WILL TERMINATE IS CALLED A TELECOM OUTLET (TO). THERE ARE SEVERAL STYLES OF OUTLETS:

NEW CONSTRUCTION

EXISTING CONSTRUCTION TYPICAL

EXISTING CONSTRUCTION VARIATIONS

TELEPHONE (VOICE) ONLY.

DATA ONLY

FURNISH AND INSTALL SPLIT CHANNEL RACEWAY AND OUTLET BOXES AS SPECIFIED IN THE DRAWINGS AND AS SPECIFIED HEREIN.

FURNISH AND INSTALL CONDUIT STUBS IN WALLS AND FLOORS FOR CABLE ROUTES.

QUALITY ASSURANCE:

ALL CABLE AND EQUIPMENT SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER. ALL METHODS OF CONSTRUCTION THAT ARE NOT SPECIFICALLY DESCRIBED OR INDICATED IN THE CONTRACT DOCUMENTS SHALL BE SUBJECT TO THE CONTROL AND APPROVAL OF THE OWNER OR OWNER REPRESENTATIVE. EQUIPMENT AND MATERIALS SHALL BE OF THE QUALITY AND MANUFACTURE INDICATED. THE EQUIPMENT SPECIFIED IS BASED UPON THE ACCEPTABLE MANUFACTURERS LISTED. WHERE “APPROVED EQUAL” IS STATED, EQUIPMENT SHALL BE EQUIVALENT IN EVERY WAY TO THAT OF THE EQUIPMENT SPECIFIED AND SUBJECT TO APPROVAL.

ASSURE THAT THE "AS INSTALLED" SYSTEM IS CORRECTLY AND COMPLETELY DOCUMENTED INCLUDING ENGINEERING DRAWINGS, MANUALS, AND OPERATIONAL PROCEDURES IN SUCH A MANNER AS TO SUPPORT MAINTENANCE AND FUTURE EXPANSION OF THE SYSTEM.

SUBMITTALS

PRODUCT DATA: FOR FEATURES, RATINGS, AND PERFORMANCE OF EACH COMPONENT SPECIFIED.

SUBMIT MANUFACTURER’S INSTRUCTIONS FOR STORAGE, HANDLING, PROTECTION, EXAMINATION, PREPARATION, OPERATION, AND INSTALLATION OF PRODUCTS. INCLUDE APPLICATION CONDITIONS OR LIMITATIONS OF USE STIPULATED BY ANY PRODUCT TESTING AGENCY. SUBMIT FOR THE FOLLOWING:

WALL BOXES

RACEWAY

CONDUIT

CONDUIT BUSHINGS

SHOP DRAWINGS:

1. COMPONENT LIST: LIST MANUFACTURER, PART NUMBER, AND QUANTITY OF EACH COMPONENT.

2. INCLUDE DIMENSIONED PLAN AND ELEVATION VIEWS OF EQUIPMENT ROOMS, LABELING EACH INDIVIDUAL COMPONENT. SHOW RACEWAY ASSEMBLIES, METHOD OF FIELD ASSEMBLY, WORKSPACE REQUIREMENTS, AND ACCESS FOR CABLE CONNECTIONS.

PRODUCTS

TELECOM OUTLETS (TO)

CAT6 TO CONSISTS OF ONE (1) " SQUARE BY 2-1/8" DEEP FLUSH MOUNTED BOX. EACH OUTLET BOX SHALL HAVE AN EMT CONDUIT STUBBED ABOVE THE DROP CEILING OR EXTENDED INTO THE HALLWAY CABLE TRAY. CONDUIT SIZE IS AS FOLLOWS UON:

FOR OUTLETS WITH 3 OR LESS CABLES, USE A 1" CONDUIT.

FOR OUTLETS WITH 3-6 CABLES, USE A 1.25" CONDUIT.

FOR ALL OTHER SIZES, CALCULATE THE FILL RATIO AT 40% FOR PROPER SIZED CONDUIT.

CAT6A TO CONSISTS OF ONE (1) 5" SQUARE BY 2-7/8" DEEP FLUSH MOUNTED BOX. EACH OUTLET BOX SHALL HAVE AN EMT CONDUIT STUBBED ABOVE THE DROP CEILING OR EXTENDED INTO THE HALLWAY CABLE TRAY. CONDUIT SIZE IS AS FOLLOWS UON:

FOR OUTLETS WITH 3 OR LESS CABLES, USE A 1.25" CONDUIT.

FOR OUTLETS WITH 3-6 CABLES, USE A TWO 1.25" CONDUIT.

FOR ALL OTHER SIZES, CALCULATE THE FILL RATIO AT 40% FOR PROPER SIZED CONDUIT.

EXISTING THE NEAREST MOUNTED CONSTRUCTION TO TYPICALLY CONSISTS OF SURFACE-MOUNTED RACEWAY INCLUDING BASE, COVER, END FITTING, ENTRANCE END FITTING, AND (2) 1" CONDUITS STUBBED OUT TOP OF ENTRANCE END FITTING TO ABOVE CEILING OR OUT TO NEAREST HALLWAY DISTRIBUTION SYSTEM. SIZE OF THE RACEWAY IS SITE DEPENDENT BASED ON NUMBER OF CONDUCTORS TO BE INSTALLED.

THE INTENT OF THE INSTALLATION OF THE TOS WHICH CONSIST OF THE RACEWAY IS AS FOLLOWS:

WHERE CEILINGS ARE ACCESSIBLE, THE RACEWAY AND ENTRANCE END FITTING SHALL EXTEND ABOVE THE CEILING AND THE CONDUITS INSTALLED ABOVE THE CEILING IN THE ROOM TO THE NEAREST HALLWAY DISTRIBUTION SYSTEM.

WHERE CEILINGS ARE PARTIALLY ACCESSIBLE, OR IF THE DRAWINGS AND/OR SPECIFICATIONS INDICATE INSTALLATION OF ACCESS PANELS, THE RACEWAY SHALL EXTEND ABOVE THE CEILING AND THE CONDUITS INSTALLED ABOVE THE CEILING IN THE ROOM TO THE NEAREST HALLWAY DISTRIBUTION SYSTEM.

WHERE CEILINGS ARE INACCESSIBLE OR NO CEILINGS EXIST, THE RACEWAY SHALL EXTEND UP AS CLOSE TO THE CEILING AS PRACTICAL TO ALLOW INSTALLATION OF CONDUITS AS HIGH AS POSSIBLE TO THE NEAREST HALLWAY DISTRIBUTION SYSTEM.

HORIZONTAL DISTRIBUTION SYSTEMS

CONDUIT SYSTEM (RENOVATIONS ONLY, WHERE CONDUIT EXISTS)

1. PROVIDE CONDUITS SECURED TO WALL ABOVE CORRIDOR CEILINGS AS SHOWN ON THE DRAWINGS OR AS SPECIFIED HEREIN FOR INSTALLATION OF TELECOMMUNICATIONS CABLES. ANY EXPOSED CONDUIT

2. CORRIDOR CONDUITS SHALL BE 4" , FURNISHED IN 10-FOOT LENGTHS WHEREVER POSSIBLE, WITH NO SHARP EDGES, REAMED AS NECESSARY, EVENLY SUPPORTED AT TWO LOCATIONS PER 10 FOOT SECTION SPACING. CONDUITS SHALL BE SIZED AND QUANTIFIED TO ACCOUNT FOR HANDLING CABLES IN ALL TO CONDUITS AT 40% FILL BACK TO THE TR AND/OR ER ROOMS. VERIFY SIZE PRIOR TO INSTALLATION. BUSHINGS AND/OR CONNECTORS ON ENDS OF ARE REQUIRED.

3. ALL CONDUITS SHALL BE INSTALLED STACKED AND ATTACHED TO WALLS UNLESS CONDITIONS EXIST WHICH PROHIBIT THIS TYPE OF INSTALLATION. WHEN THIS CONDITION EXISTS, MOUNT CONDUITS SIDE-BY-SIDE SUPPORTED WITH 3/8" ROD ATTACHED TO BUILDING STRUCTURE UTILIZING UNISTRUT CHANNEL TO FORM A TRAPEZE. DOUBLE NUT THE TOP AND BOTTOM AT THE UNISTRUT. UTILIZE CONDUIT CLAMP TO SECURE CONDUITS TO UNISTRUT.

4. PROVIDE MEASURED PULL LINE IN EACH CONDUIT RATED AT 1200 LBS. MINIMUM. INCREMENTS MUST BE IN 12" STEPS.

5. GROUNDING OF CONDUITS IS NOT REQUIRED PER #250-33, EXCEPTION NO. 2. SHALL BE PAINTED EXCEPT CONDUIT ABOVE SUSPENDED CEILINGS OR IN MECHANICAL, ELECTRICAL OR TELECOMMUNICATION ROOMS. COLOR TO MATCH THAT OF SURFACE INSTALLED UPON OR AS DIRECTED BY OWNER'S REPRESENTATIVE. COORDINATE WITH OTHER TRADES PRIOR TO PAINTING.

6. PROVIDE RESTORABLE FIRE STOPS INSIDE AND AROUND CONDUITS AS RECOMMENDED BY UL1479 OR E814 FOR ALL CONDUITS PENETRATING FIRE-RATED CONSTRUCTION. FIRE RATED CONSTRUCTION TO BE VERIFIED WITH AHJ. SEE SECTION 27 05 32 FOR MORE FIRESTOPPING INFORMATION.

CORRIDOR CABLE TRAY SYSTEM

COMPLETE WALL MOUNTED OR SUSPENDED ALUMINUM CABLE TRAY SYSTEM AND NECESSARY ACCESSORIES SHALL BE PROVIDED AS SHOWN ON PLANS. INSTALL ENTIRE CABLE TRAY SYSTEM IN ACCORDANCE WITH MANUFACTURER'S MINIMUM INSTALLATION PRACTICES AND ALL LOCAL GOVERNING CODES.

COORDINATE INSTALLATION OF CABLE TRAY WITH OTHER TRADES TO ALLOW A MINIMUM OF 12" ABOVE, 12" IN FRONT, AND 12" BELOW OF CLEARANCE FROM PIPING, CONDUITS, DUCTWORK, ETC. ALLOWANCE MUST BE PROVIDED FOR ACCESS TO THE TRAY WITH REASONABLE ROOM TO WORK. OBSTRUCTIONS TO THE TRAY MUST BE MINIMIZED AND CANNOT BLOCK MORE THAN 6 FEET OF THE TRAY AT ANY POINT IN THE RUN.

SUBMITTAL DRAWINGS, IN THE FORM OF 8 ½"X 11" CATALOG CUT SHEETS, SHALL BE PROVIDED FOR THE FOLLOWING ITEMS: CABLE TRAY, FITTINGS, ACCESSORIES AND LOAD DATA.

CABLE TRAY SHALL NOT BE LOADED BEYOND 60% OF MANUFACTURER'S RECOMMENDED LOAD CAPACITY.

INSTALL WALL MOUNTED CABLE TRAY ON BOTH SIDES OF HALLWAY AS SHOWN ON DRAWINGS AND WHERE APPLICABLE.

WHERE A NEW CABLE TRAY DISTRIBUTION SYSTEM ENCOUNTERS A WALL, INSTALL SUFFICIENT 4" SLEEVES THROUGH THE WALL SO CABLING DOES NOT EXCEED 20% FILL.

WHERE CABLE TRAY IS EXPOSED BELOW CEILING, INSTALL THE APPROPRIATE SOLID BOTTOM INSERTS TO CONCEAL CABLES.

INSTALL CABLE TRAY DROPOUTS WHERE LARGE QUANTITIES OF CABLES EXIT THE DISTRIBUTION SYSTEM.

CABLE TRAY MUST BE SIZED TO FACILITATE SUFFICIENT GROWTH CAPACITY FOR MIGRATION CABLE PLANT TO COEXIST IN SAME TRAY AS EXISTING CABLE PLANT, WHEREVER POSSIBLE.

MANUFACTURER OF CABLE TRAY IN CORRIDORS AND TELECOM ROOMS SHALL BE:

TELECOMMUNICATION ROOM CABLE TRAY SYSTEM

TR CABLE TRAY SHALL COMPLETELY WRAP ALL WALLS WITHIN THE ROOM. CABLE TRAY SHALL EXTEND OVER ALL EQUIPMENT FRAMES.

CABLE TRAY SHALL BE A MINIMUM WIDTH OF 2" HIGH X 12" WIDE. CABLE TRAY MAY BE SIZED UPWARDS IF FILL RATIO REQUIREMENTS NEED TO BE MET BASED ON CABLE QUANTITIES.

MANUFACTURER OF TUBULAR LADDER TYPE CABLE TRAY IN TELECOMMUNICATION ROOMS SHALL BE COOPER BLINE, CHATSWORTH (), COMMSCOPE OR APPROVED EQUAL.

CABLE TRAY SHALL BE 12 INCH CABLE RUNWAY.

RECTANGULAR STEEL TUBING CROSS MEMBERS WELDED AT 12-INCH INTERVALS. FINISH IN BLACK ENAMEL. COMMSCOPE, PART NUMBER CR--10L-12W OR EQUIVALENT.

12-INCH WALL ANGLE ASSEMBLY KIT – COMMSCOPE PART NUMBER CR6-12WRSK OR EQUIVALENT.

3-INCH CHANNEL RACK–TO-RUNWAY MOUNTING PLATE - COMMSCOPE PART NUMBER 2RRMK OR EQUIVALENT.

END CLOSING TUBE - COMMSCOPE PART NUMBER CRPECK OR EQUIVALENT.

CORNER CLAMP - COMMSCOPE PART NUMBER CRTJSK OR EQUIVALENT (2 REQUIRED PER END CLOSING TUBE TO COMPLETE ASSEMBLY).

ALL OPEN PATHWAY/TRAYS SHALL BE INSTALLED A MINIMUM OF SIX (6) INCHES AWAY FROM ANY LIGHT FIXTURE OR OTHER SOURCE OF EMI (ELECTROMAGNETIC INTERFERENCE).

ALL PATHWAYS SHALL BE GROUNDED PER ARTICLE 250.

PROVIDE EXTERNAL GROUNDING STRAP AT EXPANSION JOINTS, SLEEVES, AND CROSSOVER AND AT OTHER LOCATIONS WHERE PATHWAY/TRAY CONTINUITY IS INTERRUPTED.

SUPPORT ALL PATHWAYS FROM BUILDING CONSTRUCTION. DO NOT SUPPORT PATHWAYS FROM DUCTWORK, PIPING, OR EQUIPMENT HANGERS.

INSTALL CABLE TRAY LEVEL AND STRAIGHT UNLESS NOTED ON THE CONSTRUCTION DRAWINGS.

STATION CONDUITS

STATION CONDUIT IS DEFINED AS CONDUIT THAT ORIGINATES AT THE TO AND RISES WITHIN THE WALLS OR IS EXPOSED FROM A RACEWAY AND EXTENDS UP INTO THE DROP CEILING OR OVER TO THE HALLWAY DISTRIBUTION SYSTEM.

PROVIDE STATION CONDUITS FROM TOS TO ABOVE THE DROP CEILING OR EXTEND OVER TO THE HALLWAY DISTRIBUTION SYSTEMS CONSISTING OF 1" MINIMUM OR APPROPRIATE SIZE AS SHOWN ON THE DRAWINGS OR AS SPECIFIED HEREIN FOR INSTALLATION OF TELECOMMUNICATIONS CABLES.

PROVIDE AN INSULATING PRESS FIT BUSHING ON ALL TELECOMMUNICATIONS CONDUITS INCLUDING INTERCONNECTING NIPPLES AND STUB TO DISTRIBUTION SYSTEM. TO PREVENT CONFLICTS WITH OTHER CABLES OR CONDUITS TO CABLE TRAY, THE CONDUIT SHALL BE STUBBED NOT LESS THAN 6" ABOVE OR BELOW CONDUIT/CABLE TRAY CENTER LINE. WHERE SPACE PERMITS, EVERY EFFORT SHALL BE MADE TO BEND STATION CONDUITS DOWN SUCH THAT THE FLOW OF INSTALLED CABLES PROMOTES THE MINIMUM LENGTH BACK TO THE TR AND THE LEAST NUMBER OF BENDS IN THE CABLES. BUSHINGS MUST BE RATED TO BE USED IN AN ENVIRONMENTAL AIR HANDLING SPACE (PLENUM).

MANUFACTURER OF INSULATING BUSHING ON ALL TELECOMMUNICATION CONDUITS SHALL BE:

ARLINGTON, ERICO CADDY OR EQUIVALENT

PROVIDE PULL LINE IN EACH EMPTY CONDUIT TO HALLWAY DISTRIBUTION SYSTEM.

INDELIBLY MARK THE STATION CONDUIT AT HALLWAY DISTRIBUTION END WITH ROOM # THAT CONDUIT SERVES.

THE USE OF 90 DEGREE ELECTRICAL PULLING ELBOWS IS PROHIBITED.

DO NOT INCLUDE MORE THAN TWO 90-DEGREE BENDS BETWEEN PULLING POINTS WHEN INSTALLING STATION CONDUIT RUNS. IF THE PATH OF THE STATION CONDUITS REQUIRES MORE THAN 180 DEGREES OF TOTAL BENDS, INSTALLATION OF AN APPROPRIATELY SIZED JUNCTION BOX IS REQUIRED. SEE SECTION 2.4 FOR JUNCTION BOX REQUIREMENTS.

PLACE AN APPROPRIATELY SIZED JUNCTION BOX IN EACH INDIVIDUAL STATION CONDUIT RUN THAT EXCEEDS 100 FEET IN LENGTH.

THE USE OF A THIRD BEND IN A CONDUIT IS ONLY ACCEPTABLE IF:

THE TOTAL CONDUIT RUN IS REDUCED BY 15%.

THE CONDUIT SIZE IS INCREASED TO THE NEXT TRADE SIZE.

ONE OF THE BENDS IS LOCATED WITHIN 12" OF THE CABLE FEED END.

JUNCTION BOX REQUIREMENTS FOR STATION CONDUITS

IF THE STATION CONDUIT ROUTE EXCEEDS THE 180 DEGREE OF TOTAL BENDS LIMITATION, AN APPROPRIATELY SIZED JUNCTION BOX IS REQUIRED WITHIN A STRAIGHT SECTION OF THE CONDUIT RUN.

EACH STATION CONDUIT RUN REQUIRES A SEPARATE JUNCTION BOX. THE SHARING OF A JUNCTION BOX BY MULTIPLE CONDUITS IS PROHIBITED.

A JUNCTION BOX SHALL NOT BE USED IN PLACE OF A BEND. ALL JUNCTION BOXES IN STATION CONDUIT PATHS SHALL BE INSTALLED WITHIN A STRAIGHT SECTION OF THE CONDUIT RUN.

SERVICE ENTRANCE CONDUITS

ENTRANCE CONDUITS SHALL BE CONTINUOUS INTO THE BUILDING AND TO THE ER. SECURELY FASTEN ALL ENTRANCE CONDUITS TO THE BUILDING TO WITHSTAND ANY CABLE PLACING OPERATION. DO NOT INCLUDE MORE THAN TWO 90-DEGREE BENDS BETWEEN PULLING POINTS WHEN INSTALLING ENTRANCE CONDUITS.

ON EXTERIOR WALL PENETRATIONS, SEAL BOTH SIDES OF THE WALL AROUND OUTSIDE OF CONDUIT WITH HYDRAULIC CEMENT TO PREVENT WATER FROM ENTERING THE BUILDING. SEAL THE INSIDE OF THE CONDUIT ON BOTH SIDES WITH CONDUIT PLUGS, WATER PLUGS, OR DUCT SEALER TO PREVENT WATER, VAPORS, OR GASES FROM ENTERING THE BUILDING.

PATHWAY REQUIREMENTS FOR ENTRANCE CONDUITS

IF THE ENTRANCE CONDUITS EXCEED THE 180 DEGREE OF TOTAL BENDS LIMITATION, AN APPROPRIATE SIZED JUNCTION BOX, MANHOLE, OR HANDHOLE IS REQUIRED.

AS-BUILT DRAWINGS OF ENTRANCE CONDUIT PATH REQUIRED TO BE SUBMITTED TO OWNER'S REPRESENTATIVE BEFORE COVERED WITH SOIL.

RISER CONDUITS

RISER CONDUITS SHALL ONLY BE USED WHEN NOTED ON THE CONSTRUCTION DOCUMENTS FOR SPECIAL APPLICATIONS ONLY. RISER CONDUITS ARE NOT REQUIRED AS A GENERAL RULE FOR THE RISER SYSTEM. HOWEVER, WHEN REQUIRED:

A MINIMUM OF (2) 4" CONDUITS SHALL BE INSTALLED BETWEEN THE ER ROOM AND EACH TR ROOM AS SHOWN ON THE DRAWINGS.

CONDUITS ENTERING ER AND TR ROOMS SHALL BE REAMED OR BUSHED AND TERMINATED NOT MORE THAN 4" FROM ENTRANCE WALL AND WITHIN 12" OF ROOM CORNERS.

CONDUITS ENTERING ER AND TR ROOMS FROM BELOW FLOOR SHALL BE TERMINATED NOT MORE THAN 4" ABOVE FINISHED FLOOR.

CONDUITS FOR RISER CABLES SHALL BE CONTINUOUS AND SEPARATE FROM ALL OTHER CONDUIT OR ENCLOSED RACEWAY SYSTEMS. DO NOT INCLUDE MORE THAN TWO 90 DEGREE BENDS BETWEEN PULLING POINTS WHEN INSTALLING RISER CONDUITS. WHERE JUNCTION BOXES ARE REQUIRED, LOCATE IN ACCESSIBLE AREAS, SUCH AS ABOVE SUSPENDED CEILINGS IN HALLWAYS.

CONDUITS SHALL NOT BE LESS THAN 4" TRADE SIZE AND BE EQUIPPED WITH A MEASURED PULL LINE AT 12" INCREMENTS RATED AT A MINIMUM 1200-POUND TEST.

PROVIDE RESTORABLE FIRE STOPS INSIDE AND AROUND CONDUITS AS RECOMMENDED BY UL1479 OR E814 FOR ALL CONDUITS PENETRATING FIRE-RATED CONSTRUCTION. FIRE-RATED CONSTRUCTION TO BE VERIFIED WITH AHJ. SEE SECTION 27 05 32 FOR MORE FIRESTOPPING INFORMATION.

PROVIDE AN INSULATING PRESS FIT BUSHING ON ALL TELECOMMUNICATIONS RISER CONDUITS. BUSHINGS MUST BE RATED TO BE USED IN AN ENVIRONMENTAL AIR HANDLING SPACE (PLENUM).

THE MANUFACTURER OF INSULATING BUSHING ON ALL TELECOMMUNICATION CONDUITS SHALL BE ARLINGTON OR EQUAL.

RISER CONDUITS SHALL NOT BE USED FOR THE DISTRIBUTION OF HORIZONTAL CABLES.

FIRESTOPPING

IN ALL BUILDINGS, FLOOR/CEILING ASSEMBLIES, STAIRS, AND ELEVATOR PENETRATIONS MUST BE SEALED WITH A 2-HOUR FIRE STOP ASSEMBLY AT A MINIMUM, UNLESS OTHERWISE NOTED.

CONTACT OWNER'S REPRESENTATIVE TO IDENTIFY WALLS WHICH ARE FIRE-RATED CONSTRUCTION. WALLS MUST BE SEALED WITH A 2-HOUR FIRE STOP ASSEMBLY AT A MINIMUM.

COMMUNICATION PATHWAYS REQUIRING FIRE STOPPING SHALL UTILIZE REMOVABLE/RE-USABLE FIRE STOPPING PUTTIES FOR EASE OF MOVES, ADDS, AND CHANGES.

ALL FIRE STOPPING PENETRATIONS SHALL CONFORM TO THE RECOMMENDED PRACTICES LISTED IN UL1479 OR .

SEE SECTION 27 05 32 - FIRESTOPPING FOR TELECOMMUNICATIONS SYSTEMS

EXECUTION

GENERAL REQUIREMENTS

THE INTENTION OF THE TELECOMMUNICATIONS CONDUITS IS TO PROVIDE A ROUTE BETWEEN ER AND TR ROOMS, ROUTES FROM THE TRS THROUGHOUT BUILDING FLOORS TO HALLWAYS, AND ROUTES FROM HALLWAY DISTRIBUTION SYSTEMS INTO ROOMS TO INDIVIDUAL TOS FOR TELECOMMUNICATIONS CABLING.

INSTALLATION OF NEW PATHWAYS SHALL NOT INTERFERE WITH EXISTING PATHWAYS IN SUCH A WAY THAT INSTALLATION OF NEW CABLES WITHIN THE EXISTING PATHWAY IS MADE MORE DIFFICULT.

EXAMINATION

EXAMINE AREAS TO RECEIVE CABLE MANAGEMENT SYSTEM. NOTIFY THE OWNER’S REPRESENTATIVE OF CONDITIONS THAT WOULD ADVERSELY AFFECT THE INSTALLATION OR SUBSEQUENT UTILIZATION OF THE SYSTEM.

DO NOT PROCEED WITH INSTALLATION UNTIL UNSATISFACTORY CONDITIONS ARE CORRECTED.

INSTALLATION

INSTALL IN ACCORDANCE WITH RECOGNIZED INDUSTRY PRACTICES, TO ENSURE THAT THE EQUIPMENT COMPLIES WITH THE REQUIREMENTS OF THE , AND APPLICABLE PORTIONS OF NFPA 70B AND NECA "STANDARDS OF INSTALLATION" PERTAINING TO GENERAL ELECTRICAL INSTALLATION PRACTICE.

COORDINATE INSTALLATION WITH OTHER TRADES.

FIELD VERIFICATION IS REQUIRED BEFORE INSTALLATION.

INSTALL CABLE MANAGEMENT SYSTEM AT LOCATIONS INDICATED ON THE DRAWINGS AND IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

GENERAL

WORK INCLUDES

THE WORK COVERED UNDER THIS SECTION CONSISTS OF THE FURNISHING OF ALL NECESSARY LABOR, SUPERVISION, MATERIALS, EQUIPMENT, AND SERVICES TO COMPLETELY EXECUTE THE SYSTEM OF NON-CONTINUOUS CABLE SUPPORTS AS DESCRIBED IN THIS SPECIFICATION.

SCOPE OF WORK

THIS SECTION INCLUDES THE MINIMUM REQUIREMENTS FOR THE SUPPORT STRUCTURES FOR THE COMMUNICATIONS SYSTEMS FOR THE PROJECT AS OUTLINED IN THE BID DOCUMENT.

A. NON-CONTINUOUS CABLE SUPPORTS (2.3A)

B. ADJUSTABLE NON-CONTINUOUS CABLE SUPPORT SLING (2.3B)

C. MULTI-TIERED NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES (2.3C)

D. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM TEE BAR (2.3D)

E. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM DROP WIRE/CEILING (2.3E)

F. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM BEAM, FLANGE (2.3F)

G. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM C & Z PURLIN (2.3G)

H. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM WALL, CONCRETE, OR JOIST (2.3H)

I. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM THREADED ROD (2.3I)

J. RAISED FLOOR NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES (2.3J)

K. CANTILEVER-MOUNTED OPTION FOR NON-CONTINUOUS CABLE SUPPORTS (2.3K)

L. INSTALLATION ACCESSORIES FOR NON-CONTINUOUS CABLE SUPPORTS (2.3L)

SUBMITTALS

A. SUBMIT PRODUCT DATA ON NON-CONTINUOUS CABLE SUPPORT DEVICES, INCLUDING ATTACHMENT METHODS. PRODUCT DATA TO INCLUDE, BUT NOT LIMITED TO MATERIALS, FINISHES, APPROVALS, LOAD RATINGS, AND DIMENSIONAL INFORMATION.

QUALITY ASSURANCE

A. NON-CONTINUOUS CABLE SUPPORTS, AND CABLE SUPPORT ASSEMBLIES SHALL BE LISTED BY UNDERWRITERS LABORATORIES FOR BOTH CANADIAN AND US STANDARDS (CULUS).

B. NON-CONTINUOUS CABLE SUPPORTS SHALL HAVE THE MANUFACTURER'S NAME AND PART NUMBER STAMPED ON THE PART FOR IDENTIFICATION.

COORDINATION

A. COORDINATE INSTALLATION OF HANGERS SUPPORTS AND CABLES WITH OTHER TRADES.

PRODUCTS

ACCEPTABLE MANUFACTURERS

A. SUBJECT TO COMPLIANCE WITH THESE SPECIFICATIONS, NON-CONTINUOUS CABLE SUPPORTS SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

NON-CONTINUOUS CABLE SUPPORT SYSTEMS

A. NON-CONTINUOUS CABLE SUPPORTS

1. NON-CONTINUOUS CABLE SUPPORTS SHALL PROVIDE A BEARING SURFACE OF SUFFICIENT WIDTH TO COMPLY WITH REQUIRED BEND RADII OF HIGH-PERFORMANCE CABLES; CULUS LISTED.

2. NON-CONTINUOUS CABLE SUPPORTS SHALL HAVE FLARED EDGES TO PREVENT DAMAGE WHILE INSTALLING CABLES.

3. NON-CONTINUOUS CABLE SUPPORTS SIZED 1 5/16" AND LARGER SHALL HAVE A CABLE RETAINER STRAP TO PROVIDE CONTAINMENT OF CABLES WITHIN THE HANGER. THE CABLE RETAINER STRAP SHALL BE REMOVABLE AND REUSABLE AND BE SUITABLE FOR USE IN AIR HANDLING SPACES.

4. NON-CONTINUOUS CABLE SUPPORTS SHALL HAVE AN ELECTRO-GALVANIZED OR G60 FINISH AND SHALL BE RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS.

5. STAINLESS STEEL NON-CONTINUOUS CABLE SUPPORTS ARE INTENDED FOR INDOOR AND OUTDOOR USE IN NON-CORROSIVE ENVIRONMENTS OR WHERE ONLY MILDLY CORROSIVE CONDITIONS APPLY.

6. NON-CONTINUOUS CABLE SUPPORTS SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

B. ADJUSTABLE NON-CONTINUOUS CABLE SUPPORT SLING

1. CONSTRUCTED FROM STEEL AND WOVEN LAMINATE; SLING LENGTH CAN BE ADJUSTED TO HOLD UP TO 425 4-PAIR UTP; RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS. RATED TO SUPPORT CATEGORY 5E AND HIGHER CABLE, OR OPTICAL FIBER CABLE; CULUS LISTED.

2. ADJUSTABLE NON-CONTINUOUS CABLE SUPPORT SLING SHALL HAVE A STATIC LOAD LIMIT OF 100 LBS.

3. ADJUSTABLE NON-CONTINUOUS CABLE SUPPORT SLING SHALL BE SUITABLE FOR USE IN AIR HANDLING SPACES.

4. IF REQUIRED, ASSEMBLE TO MANUFACTURER RECOMMENDED SPECIALTY FASTENERS INCLUDING BEAM CLIPS, FLANGE CLIPS, C AND Z PURLIN CLIPS.

5. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

C. MULTI-TIERED NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES

1. MULTI-TIERED NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES SHALL BE USED WHERE SEPARATE CABLING COMPARTMENTS ARE REQUIRED. ASSEMBLIES MAY BE FACTORY ASSEMBLED OR ASSEMBLED FROM PRE-PACKAGED KITS. ASSEMBLIES SHALL CONSIST OF A STEEL ANGLED HANGER BRACKET HOLDING UP TO SIX NON-CONTINUOUS CABLE SUPPORTS, RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS; CULUS LISTED.

2. IF REQUIRED, THE MULTI-TIER SUPPORT BRACKET MAY BE ASSEMBLED TO MANUFACTURER RECOMMENDED SPECIALTY FASTENERS INCLUDING BEAM CLAMPS, FLANGE CLIPS, C AND Z PURLIN CLIPS.

3. THE MULTI-TIERED SUPPORT BRACKET SHALL CONSIST OF:

D. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM TEE BAR

1. TEE BAR SUPPORT BRACKET WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED; RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS; CULUS LISTED.

2. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

E. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM DROP WIRE/CEILING

1. FASTENER TO WIRE/ROD WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED; RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS; CULUS LISTED.

2. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

F. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM BEAM, FLANGE

1. FASTENER TO BEAM OR FLANGE WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED; RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS; CULUS LISTED.

2. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

G. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM C & Z PURLIN

1. FASTENER TO C OR Z PURLIN WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED; RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS, CULUS LISTED.

2. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

H. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM WALL, CONCRETE, OR JOIST

1. FASTENER TO WALL, CONCRETE, OR JOIST WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED; RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS, CULUS LISTED.

2. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

I. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM THREADED ROD

1. FASTENER TO THREADED ROD WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED, RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS, CULUS LISTED.

2. THE MULTI-TIERED SUPPORT BRACKET SHALL HAVE A STATIC LOAD LIMIT OF 300 LBS.

3. U-HOOKS AND DOUBLE J-HOOK SHALL ATTACH DIRECTLY TO THREADED ROD USING STANDARD NUTS.

4. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

J. RAISED FLOOR NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES

1. FASTENER TO RAISED (ACCESS) FLOOR PEDESTAL WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED, RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS; CULUS LISTED.

2. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

K. CANTILEVER-MOUNTED CABLE SUPPORTS

1. U-HOOK SHALL BE ABLE TO BE ASSEMBLED TO A WIDE VARIETY OF WALL MOUNT BRACKETS.

2. SPACING OF INDIVIDUAL U-HOOKS AS NEEDED, MAX OF 4' TO 5' APART.

3. U-HOOKS MAY HAVE THE OPTIONAL ATTACHMENT OF A CABLE ROLLER FOR EASE IN PULLING CABLES.

4. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

L. INSTALLATION OF ACCESSORIES FOR NON-CONTINUOUS CABLE SUPPORTS.

CABLE PULLEY

NON-CONTINUOUS CABLE SUPPORTS MAY BE USED AS AN INSTALLATION TOOL WHEN A REMOVABLE PULLEY ASSEMBLY IS INCLUDED. THE PULLEY SHALL BE MADE OF PLASTIC AND WITHOUT SHARP EDGES. THE PIN AND BAIL ASSEMBLY MUST BE ABLE TO BE SECURED TO THE J-HOOK DURING CABLE INSTALLATION. THE PULLEY MUST REMAIN SECURED WHILE CABLES ARE BEING PULLED.

THE PIN AND ROLLER ASSEMBLY MUST BE REMOVED AFTER CABLES ARE INSTALLED.

MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

CABLE PROTECTOR

THE PROTECTIVE STEEL TUBE SHALL FIT OVER THREADED ROD AND BE AT LEAST 4" IN LENGTH.

THE TUBE SHALL PREVENT DAMAGE TO CABLES PLACED IN OR PULLED THROUGH -CMTM U-HOOKS. THE TUBE SHALL NOT INHIBIT THE PULLING OF CABLES.

MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

FINISHES

A. B633 STANDARD SPECIFICATION FOR ELECTRO-DEPOSITED COATINGS OF ZINC ON IRON AND STEEL

B 695 STANDARD SPECIFICATION FOR COATINGS OF ZINC MECHANICALLY DEPOSITED ON IRON AND STEEL

A123 STANDARD SPECIFICATION FOR ZINC (HOT-DIP GALVANIZED) COATINGS ON IRON AND STEEL PRODUCTS

A924/A924M STANDARD SPECIFICATION FOR GENERAL REQUIREMENTS FOR STEEL SHEET, METALLIC-COATED BY THE HOT-DIP PROCESS

B. NON-CONTINUOUS CABLE SUPPORTS USED WHERE ONLY MILDLY CORROSIVE CONDITIONS APPLY SHALL BE STAINLESS STEEL, AISI TYPE 304.

EXECUTION

INSTALLATION

A. INSTALLATION AND CONFIGURATION SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT REVISION LEVELS OF CALIFORNIA ELECTRICAL CODE (), / EIA/TIA STANDARDS 568 & 569, APPLICABLE LOCAL CODES, AND TO THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.

B. DO NOT EXCEED LOAD RATINGS SPECIFIED BY MANUFACTURER.

C. ADJUSTABLE NON-CONTINUOUS SUPPORT SLING SHALL HAVE A STATIC LOAD LIMIT OF 100 LBS.

D. FOLLOW MANUFACTURER'S RECOMMENDATIONS FOR ALLOWABLE FILL CAPACITY FOR EACH SIZE NON-CONTINUOUS CABLE SUPPORT.

E. LOCATE PATHWAYS PER TELECOMMUNICATIONS DRAWINGS.

FIRESTOPPING FOR TELECOMMUNICATIONS SYSTEMS

GENERAL

SCOPE

THIS SECTION DESCRIBES THE REQUIREMENTS FOR FURNISHING AND INSTALLING FIRESTOPPING FOR FIRE-RATED CONSTRUCTION. THIS INCLUDES ALL OPENINGS IN FIRE-RATED FLOORS, WALLS AND OTHER RATED ELEMENTS OF CONSTRUCTION, BOTH BLANK (EMPTY) AND THOSE ACCOMMODATING ITEMS SUCH AS CABLES, CONDUITS, PIPES, DUCTS, ETC.

FIRE BLOCKING FOR CONCRETE FLOOR OR WALL SLEEVED CABLES.

FIRE BLOCKING FOR GYPSUM WALL SLEEVED CABLES.

FIRE BLOCKING FOR CONCRETE BLOCK WALL SLEEVED CABLES.

RELATED DOCUMENTS:

DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 7 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

SUBMITTALS

SUBMIT MANUFACTURER'S PRODUCT LITERATURE AND INSTALLATION PROCEDURES FOR EACH TYPE OF FIRESTOP MATERIAL TO BE INSTALLED. LITERATURE SHALL INDICATE PRODUCT CHARACTERISTICS, TYPICAL USES, PERFORMANCE AND LIMITATION CRITERIA AND TEST DATA. SUBMIT CURED SAMPLES OF FIRESTOP MATERIALS.

PRODUCT DATA: SHALL BE CLEARLY MARKED TO INDICATE ALL TECHNICAL INFORMATION WHICH SPECIFIES FULL COMPLIANCE WITH REQUIREMENTS OF THIS SECTION AND CONTRACT DOCUMENTS, INCLUDING THE FOLLOWING:

1. COPY OF UL ILLUSTRATION OF EACH PROPOSED SYSTEM INDICATING MANUFACTURER'S APPROVED MODIFICATIONS.

2. EACH CONDITION REQUIRING PENETRATION SEALS IN PROPOSED UL SYSTEMS MATERIALS, ANCHORAGE, METHODS OF INSTALLATION AND ACTUAL ADJACENT CONSTRUCTION.

QUALITY ASSURANCE

FIRESTOPPING SYSTEMS (MATERIALS AND DESIGN) SHALL CONFORM TO BOTH FLAME (F) RATINGS AND TIME (T) RATINGS AS REQUIRED BY LOCAL BUILDING CODE AND AS TESTED BY NATIONALLY ACCEPTED TEST AGENCIES PER E814 OR UL 1479 FIRE TESTS IN A CONFIGURATION THAT IS REPRESENTATIVE OF FIELD CONDITIONS.

COORDINATION

COORDINATE LAYOUT AND INSTALLATION OF FIRESTOPPING SYSTEM WITH OTHER TRADES.

REVISE LOCATIONS AND ELEVATIONS FROM THOSE INDICATED AS REQUIRED TO SUIT FIELD CONDITIONS AND AS APPROVED BY THE ARCHITECT.

PRODUCTS

ACCEPTABLE MANUFACTURERS:

MATERIALS AND PRODUCTS REQUIRED FOR WORK OF THIS SECTION SHALL NOT CONTAIN ASBESTOS OR POLYCHLORINATED BIPHENYLS (PCB).

MANUFACTURERS: 3M, , & HILTI

FIRESTOPPING SYSTEM MUST BE APPROVED BY THE LOCAL AHJ BEFORE PURCHASE OR INSTALLATION.

GENERAL

PROVIDE AND INSTALL FIRESTOPPING MATERIALS TO MEET APPLICABLE CODES AND INSTALLATION REQUIREMENTS FOR EACH FIRESTOPPING APPLICATION. PRODUCTS USING CAULKING, PUTTIES, WRAP STRIPS, MORTARS, COMPOSITE BOARDS AND/OR MECHANICAL DEVICES SHALL BE USED AS APPROPRIATE FOR THE SPECIFIC CONDITION.

CAULKING

WHEN CAULKING IS USED, PROVIDE AND INSTALL FLEXIBLE CAULKING MATERIALS. CURED FIRESTOP MATERIALS 1/8 THICK SHALL BE ABLE AROUND A 1" MANDREL WITHOUT BREAKING.

FIRESTOP

DO NOT USE ANY FIRESTOP PRODUCTS WHICH RE-EMULSIFY, LEACH ACTIVE INTUMESCENT INGREDIENTS OR DISSOLVE WHEN PLACED IN WATER AFTER CURING. PRODUCT MUST WITHSTAND THE PASSAGE OF COLD SMOKE, EITHER AS INHERENT PROPERTY OF THE SYSTEM OR BY THE USE OF A SEPARATE PRODUCT INCLUDED AS PART OF THE UL SYSTEM OR DEVICE AND DESIGNED TO PERFORM THIS FUNCTION.

PENETRATION SEALS

GENERAL:

PENETRATION SEALS (FIRESTOPPING MATERIAL) SHALL BE ASBESTOS-FREE AND CAPABLE OF MAINTAINING AN EFFECTIVE BARRIER AGAINST FLAME, SMOKE AND GASES IN COMPLIANCE WITH REQUIREMENTS OF E814 AND UL 1479.

MATERIALS SHALL MEET AND BE ACCEPTABLE FOR USE BY ALL THREE MODEL BUILDING CODES, BASIC/CALIFORNIA BUILDING CODE, BUILDING CODE AND STANDARD BUILDING CODE, PER NATIONAL EVALUATION SERVICE, INC. REPORT # -243.

MATERIALS SHALL MEET THE REQUIREMENTS OF NFPA 101 AND .

MATERIALS SHALL BE SUITABLE FOR THE FIRESTOPPING OF PENETRATIONS MADE BY STEEL, GLASS, PLASTIC AND INSULATED PIPE, CONDUIT, BUS DUCT, NON-INSULATED PIPE, AND DUCTWORK.

ON INSULATED PIPE, FIRE-RATING CLASSIFICATION MUST NOT REQUIRE REMOVAL OF INSULATION.

THE RATING OF PENETRATION SEALS SHALL NOT BE LESS THAN THE RATING OF THE TIME-RATED FLOOR OR WALL ASSEMBLY.

THE SYSTEMS SHOWN BELOW ARE EXAMPLES AND OTHER EQUAL SYSTEMS MAY BE APPROVED OR REQUIRED BY THE AHJ.

2-HOUR RATED CONCRETE FLOOR:

PENETRANTS: MULTIPLE PIPES.

UL SYSTEM: NO. 93.

2-HOUR RATED CONCRETE FLOOR:

PENETRANTS: MAXIMUM 30” DIA. METAL PIPE/CONDUIT.

UL SYSTEM: NO.319

1-2 –HOUR RATED GYPSUM BOARD WALL:

PENETRANT: METAL PIPE/CONDUIT.

UL SYSTEM: NO. 147

2-HOUR RATED GYPSUM BOARD WALL:

PENETRANT: METAL PIPE/CONDUIT.

UL SYSTEM: NO. 147.

3-HOUR RATED CONCRETE WALL:

PENETRANT: METAL DUCT, MAXIMUM 2’ SQUARE AND MAXIMUM DIMENSION OF 30”.

UL SYSTEM: NO. 105.

WALLS BELOW GRADE:

PENETRANTS: PIPE SLEEVES.

SEAL: THUNDERLINE “LINK SEAL” CASING SEAL.

EXECUTION

INSPECTION

EXAMINE THE AREAS AND CONDITIONS WHERE FIRESTOPS ARE TO BE INSTALLED AND NOTIFY THE ARCHITECT OF CONDITIONS DETRIMENTAL TO THE PROPER AND TIMELY COMPLETION OF THE WORK. DO NOT PROCEED WITH WORK UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED BY THE CONTRACTOR IN A MANNER ACCEPTABLE TO THE ARCHITECT.

CONDITIONS REQUIRING FIRESTOPPING

GENERAL – PROVIDE FIRESTOPPING FOR CONDITIONS SPECIFIED WHETHER OR NOT FIRESTOPPING IS INDICATED, AND IF INDICATED, WHETHER SUCH MATERIAL IS DESIGNED AS INSULATION, SAFING, OR OTHERWISE.

AT ANY POINT WHERE A FIRE RATED WALL IS PENETRATED WITH CABLE OR CONDUIT.

PENETRATIONS

1. PENETRATIONS INCLUDE CONDUIT, CABLE WIRE, PIPE, DUCT OR OTHER ELEMENTS WHICH PASS THROUGH ONE OR BOTH OUTER SURFACES OF A FIRE RATED FLOOR, WALL OR PARTITION.

2. THESE REQUIREMENTS FOR PENETRATIONS SHALL APPLY WHETHER OR NOT SLEEVES HAVE BEEN PROVIDED, AND WHETHER OF NOT PENETRATIONS ARE TO BE EQUIPPED WITH ESCUTCHEONS OR OTHER TRIM. IF PENETRATIONS ARE SLEEVED FIRESTOP ANY ANNULAR SPACE BETWEEN THE SLEEVE AND WALL OPENING.

PROVIDE FIRESTOPPING TO FILL MISCELLANEOUS VOIDS AND OPENINGS IN FIRE-RATED CONSTRUCTION AS SPECIFIED HEREIN.

3.3 INSTALLATION

GENERAL

INSTALLATION OF FIRESTOPS SHALL BE PERFORMED BY A APPLICATOR/INSTALLER QUALIFIED AND TRAINED BY THE MANUFACTURER. INSTALLATION SHALL BE PERFORMED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S DETAILED INSTALLATION PROCEDURES.

APPLY FIRESTOPS IN ACCORDANCE WITH FIRE TEST REPORTS, FIRE RESISTANCE REQUIREMENTS, ACCEPTABLE SAMPLE INSTALLATIONS, AND MANUFACTURER'S RECOMMENDATIONS.

COORDINATE WITH PLUMBING, MECHANICAL, ELECTRICAL, AND OTHER TRADES TO ASSURE THAT ALL PIPE, CONDUIT, CABLE, AND OTHER ITEMS WHICH PENETRATE FIRE-RATED CONSTRUCTION HAVE BEEN PERMANENTLY INSTALLED PRIOR TO INSTALLATION OF FIRESTOP.

FIELD QUALITY CONTROL

PREPARE AND INSTALL FIRESTOPPING SYSTEMS IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTRUCTIONS AND RECOMMENDATIONS.

FOLLOW SAFETY PROCEDURES RECOMMENDED IN THE MATERIAL SAFETY DATA SHEETS.

FINISH SURFACES OF FIRESTOPPING WHICH IS TO REMAIN EXPOSED IN THE COMPLETED WORK TO A UNIFORM AND LEVEL CONDITION.

ALL AREAS OF WORK MUST BE ACCESSIBLE UNTIL INSPECTION BY THE APPLICABLE CODE AUTHORITIES.

CORRECT UNACCEPTABLE FIRESTOPS AND PROVIDE ADDITIONAL INSPECTION TO VERIFY COMPLIANCE WITH THIS SPECIFICATION AT NO ADDITIONAL COST.

CALCULATE THE MAXIMUM CABLE FILL RATIO FOR EACH FIRESTOPPING SYSTEM AND CABLE TYPE. DO NOT EXCEED THE MAXIMUM FILL RATIO.

PREPARE AND INSTALL FIRESTOPPING SYSTEMS IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTRUCTIONS AND RECOMMENDATIONS.

WARRANTY

A. COMPLY WITH GENERAL CONDITIONS, AND INCLUDE BUT NOT BE LIMITED TO:

1. REPAIRS AND REPLACEMENT OF PENETRATION SEALS WHICH FAIL IN JOINT ADHESION, COHESION, ABRASION, RESISTANCE, WEATHER RESISTANCE, EXTRUSION RESISTANCE, MIGRATION RESISTANCE, STAIN RESISTANCE, OR GENERAL DURABILITY, OR APPEAR TO DETERIORATE IN ANY OTHER MANNER NOT CLEARLY SPECIFIED IN SUBMITTED MANUFACTURER'S DATA AS AN INHERENT QUALITY OF THE MATERIAL FOR EXPOSURE INDICATED.

CLEANING

REMOVE SPILLED AND EXCESS MATERIALS ADJACENT TO FIRESTOPPING WITHOUT DAMAGING ADJACENT SURFACES.

LEAVE FINISHED WORK IN NEAT, CLEAN CONDITION WITH NO EVIDENCE OF SPILLOVERS OR DAMAGE TO ADJACENT SURFACES.

CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

GENERAL

OUTLETS CAT5E AND CAT6

EACH DATA OUTLET IN A WALL OR FLOOR SHALL BE SERVED BY TWO (2) 1 IN. CONDUITS AND A DOUBLE-GANG DEEP DEVICE BOX WITH A SINGLE-GANG MUD RING.

WALL MOUNTED TELEPHONES SHALL BE SERVED BY ONE 0.75 IN. CONDUIT AND A SINGLE-GANG DEEP DEVICE BOX WITH A SINGLE-GANG MUD RING. THE OUTLET BOX SHALL BE MOUNTED AT A CENTER HEIGHT OF 48 IN. ABOVE THE FINISHED FLOOR, UNLESS OTHERWISE SPECIFIED ON THE DRAWING, AND SHALL HAVE A CLEARANCE OF 12 IN. OF WALL SURFACE ON ALL SIDES.

ALL OUTLET CONDUITS SHALL BE STUBBED INTO ACCESSIBLE CEILING SPACE.

ALL OUTLET CONDUITS SHALL HAVE BURRS AND ANY OTHER ABRASIVE ELEMENTS REMOVED AND AN INSULATING BUSHING SHALL BE INSTALLED ON BOTH ENDS.

NO SECTION OF CONDUIT SHALL BE LONGER THAN 30 M (100 FT.) BETWEEN PULL POINTS.

NO MORE THAN 180 DEGREES OF CONDUIT BENDS SHALL BE PERMITTED BETWEEN PULL POINTS.

THE MINIMUM INSIDE RADIUS FOR ANY BEND OF AN OUTLET CONDUIT SHALL BE SIX TIMES THE INSIDE DIAMETER OF THAT CONDUIT.

OUTLETS CAT6A

EACH DATA OUTLET IN A WALL OR FLOOR SHALL BE SERVED BY TWO (2) 1.25 IN. CONDUITS AND A 5-SQUARE DOUBLE-GANG DEEP DEVICE BOX WITH A SINGLE-GANG MUD RING.

APPROVED MANUFACTURES: STEEL CITY, RAND-L, OR APPROVED EQUAL

ALL OUTLET CONDUITS SHALL BE STUBBED INTO ACCESSIBLE CEILING SPACE.

ALL OUTLET CONDUITS SHALL HAVE BURRS AND ANY OTHER ABRASIVE ELEMENTS REMOVED AND AN INSULATING BUSHING SHALL BE INSTALLED ON BOTH ENDS.

NO SECTION OF CONDUIT SHALL BE LONGER THAN 30 M (100 FT.) BETWEEN PULL POINTS.

NO MORE THAN 180 DEGREES OF CONDUIT BENDS SHALL BE PERMITTED BETWEEN PULL POINTS.

THE MINIMUM INSIDE RADIUS FOR ANY BEND OF AN OUTLET CONDUIT SHALL BE SIX TIMES THE INSIDE DIAMETER OF THAT CONDUIT.

CONDUITS

ELECTRIC METALLIC TUBING: COMPLY WITH UL 797. TUBING SHALL HAVE HOT DIPPED GALVANIZED EXTERIOR, ENAMEL-COATED INTERIOR.

FLEXIBLE CONDUIT SHALL NOT BE USED IN LIEU OF CONDUIT BENDS AND OFFSETS.

PVC CONDUIT: COMPLY WITH UL 651, LISTED FOR USE WITH 90 DEGREES C CONDUCTORS OPERATING AT 90 DEGREES C.

STANDARDS COMPLIANCE

GENERAL STANDARDS: COMPLY WITH CURRENT REVISION OF TIA 569 AS AMENDED.

SUBMITTALS

PROVIDE PRODUCT DATA FOR THE FOLLOWING:

MANUFACTURERS CUT SHEETS, SPECIFICATIONS, AND INSTALLATION INSTRUCTIONS FOR ALL PRODUCTS (SUBMIT WITH BID).

COORDINATION

COORDINATE INSTALLATION OF LABELS WITH OTHER TRADES.

STORAGE AND HANDLING: AVOID BREAKAGE, DENTING AND SCORING FINISHES. DAMAGED PRODUCTS WILL NOT BE INSTALLED. STORE MATERIALS IN ORIGINAL CARTONS AND IN A CLEAN DRY SPACE; PROTECT FROM WEATHER AND CONSTRUCTION TRAFFIC. WET MATERIALS WILL BE UNPACKED AND DRIED BEFORE STORAGE.

PRODUCTS

APPROVED PRODUCTS

DRY LOCATION DEVICE BOXES: MANUFACTURER SHALL BE:

STEEL CITY, RAND-L, HUBBELL, OR RACO
EQUIVALENT PRODUCTS BY OTHER MANUFACTURERS MAY BE USED WHERE APPROVED IN WRITING BY OWNER'S REPRESENTATIVE.

MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

WET LOCATION BOXES: MANUFACTURER SHALL BE:

STEEL CITY, RAND-L, HUBBELL, OR RACO
EQUIVALENT PRODUCTS BY OTHER MANUFACTURERS MAY BE USED WHERE APPROVED IN WRITING BY OWNER'S REPRESENTATIVE.

MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

EXECUTION

INSTALLATION

INSTALLATION AND CONFIGURATION SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT REVISION LEVELS OF CALIFORNIA ELECTRICAL CODE (), / EIA/TIA STANDARDS 568 & 569, APPLICABLE LOCAL CODES, AND TO THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.

INSTALL CONDUITS USING TECHNIQUES, PRACTICES, AND METHODS THAT ARE CONSISTENT WITH CATEGORY 6 OR HIGHER REQUIREMENTS AND THAT SUPPORTS CATEGORY 6 OR HIGHER PERFORMANCE OF COMPLETED AND LINKED SIGNAL PATHS, END TO END.

FOLLOW MANUFACTURER'S RECOMMENDATIONS FOR ALLOWABLE FILL CAPACITY FOR EACH SIZE NON-CONTINUOUS CABLE SUPPORT.

CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

GENERAL

SCOPE

CONTINUOUS, RIGID, WELDED STEEL OR STAINLESS-STEEL WIRE MESH CABLE MANAGEMENT SYSTEM.

CABLE TRAY SYSTEMS ARE DEFINED TO INCLUDE, BUT ARE NOT LIMITED TO, STRAIGHT SECTIONS, SUPPORTS AND ACCESSORIES.

RELATED DOCUMENTS:

DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 1 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

QUALITY ASSURANCE

SOURCE LIMITATIONS: OBTAIN CABLE TRAY COMPONENTS THROUGH ONE SOURCE FROM A SINGLE MANUFACTURER.

COMPLY WITH CALIFORNIA ELECTRICAL CODE, ARTICLE 392: CABLE TRAYS; PROVIDE UL CLASSIFICATION AND LABELS.

COORDINATION

COORDINATE LAYOUT AND INSTALLATION OF CABLE TRAY WITH OTHER TRADES.

REVISE LOCATIONS AND ELEVATIONS FROM THOSE INDICATED AS REQUIRED TO SUIT FIELD CONDITIONS AND AS APPROVED BY THE ARCHITECT.

PRODUCTS

MANUFACTURERS

SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY THE FOLLOWING:

MATERIALS AND FINISHES:

CABLE TRAY MATERIALS:

CARBON STEEL WIRE, A 510, GRADE 1008. WIRE WELDED, BENT, AND SURFACE TREATED AFTER MANUFACTURE.

CABLE TRAY FINISHES:

FINISH FOR CARBON STEEL WIRE AFTER WELDING AND BENDING OF MESH.

ELECTRODEPOSITED ZINC PLATING: B 633, TYPE III, SC-1.

POWDER-COATED TRAYS – UL CLASSIFIED BLACK POWDER-COATED SURFACE TREATMENT OVER ELECTRODEPOSITED ZINC PLATING (OR PLAIN STEEL) USING ASA 61 BLACK POLYESTER COATING.

CABLE TRAY WILL CONSIST OF CONTINUOUS, RIGID, WELDED STEEL WIRE MESH CABLE MANAGEMENT SYSTEM, TO ALLOW CONTINUOUS VENTILATION OF CABLES AND MAXIMUM DISSIPATION OF HEAT, WITH UL CLASSIFIED SPLICES WHERE TRAY(INCLUDING UL CLASSIFIED PAINTED TRAY) ACTS AS EQUIPMENT GROUNDING CONDUCTOR (EGC). WIRE MESH CABLE TRAY WILL HAVE CONTINUOUS SAFE-T-EDGE T-WELDED TOP SIDE WIRE TO PROTECT CABLE INSULATION AND INSTALLERS.

PROVIDE SPLICES, SUPPORTS, AND OTHER FITTINGS NECESSARY FOR A COMPLETE, CONTINUOUSLY GROUNDED SYSTEM.

MESH: 2 X 4 INCHES (50 X 100 MM).

STRAIGHT SECTION LENGTHS: 118 INCHES (3,000 MM).

WIRE DIAMETER: PATENTED DESIGN INCLUDES VARYING WIRE SIZES TO MEET APPLICATION LOAD REQUIREMENTS; TO OPTIMIZE TRAY STRENGTH; AND TO ALLOW TRAY TO REMAIN LIGHTWEIGHT.

SAFE-T-EDGE: PATENTED SAFE-T-EDGE TECHNOLOGY ON SIDE WIRE TO PROTECT CABLE INSULATION AND INSTALLERS' HANDS.

FITTINGS: WIRE MESH CABLE TRAY FITTINGS ARE FIELD FABRICATED FROM STRAIGHT TRAY SECTIONS, IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND ITEM 2.3.

CF SERIES CABLE TRAY SIZE:

DEPTH: CABLE TRAY DEPTH WILL BE 4 INCHES

WIDTH: CABLE TRAY WIDTH WILL BE 6 ,12, 18, OR 24 INCHES AS SHOWN ON TELECOMMUNICATIONS DRAWINGS:

LENGTH: CABLE TRAY SECTION LENGTH WILL BE 118 INCHES (3000MM) UNLESS OTHERWISE SHOWN ON DRAWINGS.

FILL RATIO: CABLE TRAY MAY BE FILLED TO TOTAL FILL CAPACITY PER . MINIMUM 20% SPARE CAPACITY RECOMMENDED TO ACCOMMODATE FUTURE CABLING CHANGES OR ADDITIONS.

LOAD SPAN CRITERIA:

CABLE TRAY WILL BE CAPABLE OF CARRYING A UNIFORMLY DISTRIBUTED LOAD OF 50 POUNDS PER FOOT ON AN 8 FT SUPPORT SPAN, ACCORDING TO LOAD TESTS OF STANDARD SHOWN IN ITEM A ABOVE.

CABLE TRAY SUPPORTS & ACCESSORIES

FITTINGS/SUPPORTS: WIRE MESH CABLE TRAY FITTINGS ARE FIELD FABRICATED FROM STRAIGHT TRAY SECTIONS, IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. SUPPORTS WILL INCLUDE THE FAS (FAST ASSEMBLY SYSTEM) WHERE POSSIBLE SO THAT SCREWS, BOLTS, AND ADDITIONAL TOOLS ARE NOT REQUIRED FOR CABLE TRAY MOUNTING; INSTALLATION TIME IS REDUCED; AND TRAY PATH CAN ADAPT TO INSTALLATION OBSTACLES WITHOUT THE NEED FOR ADDITIONAL PARTS. PLACE SUPPORTS SO THAT SUPPORT SPAN DOES NOT EXCEED THAT SHOWN ON THE DRAWINGS.

FAS SYSTEM SUPPORT METHODS TO MOUNT FROM CEILING AND WALL STRUCTURES WITH 1/4", 3/8" OR 1/2" THREADED ROD, IF APPLICABLE

SPLICES, INCLUDING THOSE APPROVED FOR ELECTRICAL CONTINUITY (BONDING), AS RECOMMENDED BY CABLE TRAY MANUFACTURER. SELECT ONE OF THE FOLLOWING SPLICING METHODS, IF APPLICABLE:

UL CLASSIFIED EDRN FAST SPLICE: NO HARDWARE REQUIRED.

UL CLASSIFIED SPLICE WASHER KIT: SWAGED SET FOR SPLICING, TURNS, BENDS, TEES

UL CLASSIFIED ED UNIVERSAL SPLICE BAR: CUT & BEND TO FIT ANY CONFIGURATION.

PRECLICK SPLICE: BOLTED CONNECTION OPTIONAL

UL CLASSIFIED SPLICE PLATE: BOLTED CONNECTION

UL CLASSIFIED CE 25 & CE 30 SQUARE SPLICE WASHERS: USE WITH EZ BN ¼" NUT & BOLT

UL CLASSIFIED CE 40 SQUARE SPLICE WASHER: USE WITH EZ BN ¼" TO SPLICE TRAYS ON BENDS, ADJUSTABLE TEES

FASLOCK SPLICE: FOR SWEEPS AND BENDS WITH TRAY 12" (300MM) AND WIDER.

UL CLASSIFIED EZ T 90 KIT: FOR TEES AND 90S

UL CLASSIFIED RADT90 KIT: FOR 5-1/2" RADIUS TEES AND 90S

ACCESSORIES: AS REQUIRED TO PROTECT, SUPPORT, AND INSTALL A CABLE TRAY SYSTEM. SELECT FROM THE FOLLOWING ACCESSORIES, IF APPLICABLE:

EQUIPMENT GROUNDING CONDUCTOR FUNCTION & GROUNDING

UL CLASSIFIED CABLE TRAYS (INCLUDING PAINTED TRAY) MAY ACT AS EQUIPMENT GROUNDING CONDUCTORS.

USE UL CLASSIFIED SPLICING METHODS TO ENSURE CABLE TRAY IS ELECTRICALLY CONTINUOUS AND BONDED AS RECOMMENDED.

GROUND CABLE TRAYS AT END OF CONTINUOUS RUN.

TEST CABLE TRAY SYSTEM PER NFPA70B, CHAPTER 18 TO VERIFY GROUNDING LESS THAN 1 OHM.

GROUND CABLE TRAYS AGAINST FAULT CURRENT, NOISE, LIGHTNING, AND ELECTROMAGNETIC INTERFERENCE BY MOUNTING GROUNDING WIRE TO EACH 10' CABLE TRAY SECTION WITH GROUNDING CLAMP.

EXECUTION

EXAMINATION:

EXAMINE SUBSTRATES FOR COMPLIANCE WITH REQUIREMENTS FOR INSTALLATION TOLERANCES AND OTHER CONDITIONS AFFECTING PERFORMANCE OF CABLE TRAYS. DO NOT PROCEED WITH INSTALLATION UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

INSTALLATION

INSTALL CABLE TRAY LEVEL AND PLUMB ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS, COORDINATION DRAWINGS, ORIGINAL DESIGN, AND REFERENCED STANDARDS.

CUTTING: FIELD-FABRICATED CHANGES IN DIRECTION & ELEVATION BY CUTTING & BENDING CABLE TRAY.

CUT CABLE TRAY WIRES IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

CABLE TRAY WIRES MUST BE CUT WITH SIDE-ACTION BOLT CUTTERS WITH OFFSET HEAD TO ENSURE INTEGRITY OF PROTECTIVE GALVANIC LAYER.

REMOVE BURRS AND SHARP EDGES FROM CABLE TRAYS.

UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS

OUTDOOR TELECOMMUNICATIONS PATHWAYS CONNECT BUILDING, PEDESTALS, MAINTENANCE HOLES, HANDHOLDS, AND TOWERS. THESE PATHWAYS CONSIST OF UNDERGROUND, DIRECT-BURIED OR AERIAL. UNDERGROUND OR DIRECT-BURIED ARE GENERALLY PREFERRED OVER AERIAL BECAUSE OF AESTHETICS AND SECURITY. GENERALLY, UNDERGROUND DUCT BANKS ARE PREFERRED OVER DIRECT-BURIED BECAUSE OF SECURITY, EASE OF FUTURE CABLE INSTALLATION AND MAINTENANCE.

CONDUIT TYPES

EXAMPLES OF CONDUIT TYPES INCLUDE:

— DB-120 – FOR DIRECT BURIAL OR ENCASEMENT IN CONCRETE;

— RIGID NONMETALLIC CONDUIT SCHEDULE 40 – FOR DIRECT BURIAL OR ENCASEMENT IN CONCRETE;

— RIGID NONMETALLIC CONDUIT SCHEDULE 80 – FOR DIRECT BURIAL OR ENCASEMENT IN CONCRETE;

— MULTIPLE PLASTIC DUCT (MPD) – FOR DIRECT BURIAL OR INSTALLATION IN CONDUIT;

— RIGID METALLIC CONDUIT – FOR DIRECT BURIAL OR ENCASEMENT IN CONCRETE;

— INTERMEDIATE METALLIC CONDUIT – FOR DIRECT BURIAL OR ENCASEMENT IN CONCRETE;

— INNERDUCT POLYETHYLENE (PE) – FOR DIRECT BURIAL OR INSTALLATION IN CONDUIT;

— INNERDUCT POLYVINYL CHLORIDE (PVC) – FOR DIRECT BURIAL OR INSTALLATION IN CONDUIT

INSTALLATION

THE LENGTH OF CONDUIT BETWEEN PULLING POINTS SHALL NOT EXCEED 600 FT (183M).

MANUFACTURED BENDS SHOULD BE USED WHENEVER POSSIBLE. NO SECTION OF CONDUIT SHALL CONTAIN MORE THAT TWO 90-DEGREE BENDS, OR EQUIVALENT BETWEEN PULL POINTS.

CONDUITS SHOULD BE INSTALLED SUCH THAT A SLOPE EXISTS TO ALLOW DRAINAGE AND PREVENT THE ACCUMULATION OF WATER.

WHEN CONDUITS CONNECT MAINTENANCE HOLES, A SLOPE OF .125 IN PER FOOT (10 MM PER METER) SHOULD EXITS FROM THE MIDDLE OF THE SPAN TO EACH MAINTENANCE HOLE.

CONDUITS MUST BE BURIED AT A MINIMUM DEPTH OF 18 IN. (45.7 CM).

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

GENERAL

WORK INCLUDES

WORK COVERED BY THIS SECTION SHALL CONSIST OF FURNISHING LABOR, EQUIPMENT AND MATERIALS NECESSARY FOR THE LABELING OF THE TELECOMMUNICATIONS INFRASTRUCTURE AS DESCRIBED ON THE DRAWINGS AND/OR REQUIRED BY THESE SPECIFICATIONS.

SCOPE OF WORK

THIS SECTION INCLUDES THE MINIMUM REQUIREMENTS FOR THE IDENTIFICATION AND LABELING OF THE COMMUNICATIONS SYSTEMS FOR THE PROJECT AS OUTLINED IN THE BID DOCUMENT.

SUMMARY

ADMINISTRATION OF THE TELECOMMUNICATIONS INFRASTRUCTURE INCLUDES DOCUMENTATION OF CABLES, TERMINATION HARDWARE, PATCHING AND CROSS-CONNECTION FACILITIES, CONDUITS, OTHER CABLE PATHWAYS, TELECOMMUNICATIONS ROOMS, AND OTHER TELECOMMUNICATIONS SPACES. ALL FACILITIES SHALL APPLY AND MAINTAIN A SYSTEM FOR DOCUMENTING AND ADMINISTERING THE TELECOMMUNICATIONS INFRASTRUCTURE.

INDUSTRY LABELING STANDARDS AND CONVENTIONS SHALL BE USED UNLESS OTHERWISE STATED IN THE BID DOCUMENTS OR BY THE OWNER'S REPRESENTATIVE.

TELECOMMUNICATIONS INFRASTRUCTURE RECORDS MUST BE MAINTAINED IN A COMPUTER SPREADSHEET, OR IN A COMPUTER DATABASE. PAPER RECORDS ARE ENCOURAGED, BUT ARE OPTIONAL. A CABLE RECORD IS PREPARED FOR EACH BACKBONE CABLE. THE RECORD WILL SHOW THE CABLE NAME, AND MUST DESCRIBE THE ORIGIN POINT AND DESTINATION POINT OF THE CABLE. THE CABLE RECORD WILL RECORD WHAT SERVICES AND/OR CONNECTIONS ARE ASSIGNED TO EACH CABLE PAIR OR STRAND. AN EQUIPMENT RECORD IS PREPARED FOR SERVICES DISTRIBUTED FROM A CERTAIN PIECE OF EQUIPMENT, SUCH AS A ROUTER, OR A SYSTEM SUCH AS THE TELEPHONE SYSTEM PBX.

INSTALLER SHALL MAINTAIN ACCURATE, UP-TO-DATE INSTALLATION OR CONSTRUCTION DRAWINGS. AT A MINIMUM, THE INSTALLATION DRAWINGS SHALL SHOW PATHWAY LOCATIONS AND ROUTING, CONFIGURATION OF TELECOMMUNICATIONS SPACES INCLUDING BACKBOARD AND EQUIPMENT RACK CONFIGURATIONS, AND WIRING DETAILS INCLUDING IDENTIFIER ASSIGNMENTS.

INSTALLER SHALL PROVIDE A COMPLETE AND ACCURATE SET OF AS-BUILT DRAWINGS. THE AS-BUILT DRAWINGS SHALL RECORD THE IDENTIFIERS FOR MAJOR INFRASTRUCTURE COMPONENTS INCLUDING; THE PATHWAYS, SPACES, AND WIRING PORTIONS OF THE INFRASTRUCTURE WHICH MAY EACH MAY HAVE SEPARATE DRAWINGS IF WARRANTED BY THE COMPLEXITY OF THE INSTALLATION, OR THE SCALE OF THE DRAWINGS.

QUALITY ASSURANCE

ALL LABELS SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER. ALL METHODS OF LABELING THAT ARE NOT SPECIFICALLY DESCRIBED OR INDICATED IN THE CONTRACT DOCUMENTS SHALL BE SUBJECT TO THE CONTROL AND APPROVAL OF THE OWNER OR OWNER REPRESENTATIVE.

LABELS SHALL BE OF THE QUALITY AND MANUFACTURE INDICATED. THE LABELS AND LABELING EQUIPMENT SPECIFIED ARE BASED UPON THE ACCEPTABLE MANUFACTURERS LISTED. WHERE "APPROVED EQUAL" IS STATED, EQUIPMENT SHALL BE EQUIVALENT IN EVERY WAY TO THAT OF THE EQUIPMENT SPECIFIED AND SUBJECT TO APPROVAL.

STRICTLY ADHERE TO ALL BUILDING INDUSTRY CONSULTING SERVICE INTERNATIONAL (BICSI), ELECTRONIC INDUSTRIES ALLIANCE (EIA) AND TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA) RECOMMENDED INSTALLATION PRACTICES WHEN INSTALLING COMMUNICATIONS/DATA LABELING.

PRODUCTS

LABELS

SHALL BE PREPRINTED OR COMPUTER PRINTED TYPE. HANDWRITTEN LABELS ARE NOT ACCEPTABLE.

WHERE INSERT TYPE LABELS ARE USED PROVIDE CLEAR PLASTIC COVER OVER LABEL.

OUTSIDE PLANT LABELS SHALL BE TOTALLY WATERPROOF EVEN WHEN SUBMERGED.

EXECUTION

IDENTIFICATION & LABELING

THE SIZE, COLOR, AND CONTRAST OF ALL LABELS SHOULD BE SELECTED TO ENSURE THAT THE IDENTIFIERS ARE EASILY READ. LABELS SHOULD BE VISIBLE DURING THE INSTALLATION OF AND NORMAL MAINTENANCE OF THE INFRASTRUCTURE.

LABELS SHOULD BE RESISTANT TO THE ENVIRONMENTAL CONDITIONS AT THE POINT OF INSTALLATION (SUCH AS MOISTURE, HEAT, OR ULTRAVIOLET LIGHT), AND SHOULD HAVE A DESIGN LIFE EQUAL TO OR GREATER THAN THAT OF THE LABELED COMPONENT.

ALL LABELS SHALL BE PRINTED OR GENERATED BY A MECHANICAL DEVICE.

TELECOMMUNICATION IDENTIFIERS

OUTSIDE PLANT CABLING SHALL BE CLEARLY MARKED USING PERMANENT MEANS. OUTSIDE PLANT SHALL USE THE FOLLOWING SYSTEM OF NUMBERING AND LABELING:

FIBER OPTIC:

IDENTIFY: FAR-END BUILDING NAME, BUILDING NUMBER, FIBER-TYPE AND STRAND-COUNT

LABEL AT ENTRANCE AND EXIT POINTS OF TUNNEL SYSTEM AND AT CONDUIT ENTRY POINTS BETWEEN 12 INCHES AND 36 INCHES FROM THE CONDUIT OR AT CLOSET POINT THAT IS CLEARLY VISIBLE AND LONG CABLE LENGTH IN TUNNEL AT 200-FOOT INTERVALS.

LABEL AT TERMINATION PANELS AT BOTH ENDS.

COPPER:

IDENTIFY: FAR-END BUILDING NAME, BUILDING NUMBER AND STRAND-COUNT

LABEL AT ENTRANCE AND EXIT POINTS OF TUNNEL SYSTEM AND AT CONDUIT ENTRY POINTS BETWEEN 12 INCHES AND 36 INCHES FROM THE CONDUIT OR AT CLOSET POINT THAT IS CLEARLY VISIBLE AND LONG CABLE LENGTH IN TUNNEL AT 200-FOOT INTERVALS.

RISER CABLING SHALL BE CLEARLY MARKED USING PERMANENT MEANS. RISER CABLING SHALL USE THE FOLLOWING SYSTEM OF NUMBERING AND LABELING:

FIBER OPTIC:

IDENTIFY: FAR-END EF / ER / TR, FIBER-TYPE AND STRAND-COUNT.

WHEN SMALL FACILITIES ARE FED FROM A PRIMARY LOCATION AND TREATED AS AN ER, RISER SHALL BE LABELED SIMILAR TO OUTSIDE PLANT FIBER OPTIC.

COPPER:

IDENTIFY: FAR-END EF / ER / TR AND PAIR-COUNT

TERMINATION POINTS SHALL BE LABELED AS TO ACTUAL PAIR AT EVERY FIFTH (5TH) PAIR-POINT.

LABELING PROCEDURES

TO BE CONSISTENT WITH /TIA/EIA STANDARDS AND INDUSTRY PRACTICES, IT IS IMPORTANT THAT BOTH LABELING AND COLOR CODING BE APPLIED TO ALL TELECOMMUNICATIONS INFRASTRUCTURE COMPONENTS. LABELING WITH THE UNIQUE IDENTIFIER WILL IDENTIFY A PARTICULAR COMPONENT. PROPER COLOR CODING WILL QUICKLY IDENTIFY HOW THAT COMPONENT IS USED IN THE OVERALL TELECOMMUNICATIONS INFRASTRUCTURE OF THE FACILITY.

VISIBILITY AND DURABILITY:

THE SIZE, COLOR, AND CONTRAST OF ALL LABELS SHOULD BE SELECTED TO ENSURE THAT THE IDENTIFIERS ARE EASILY READ. LABELS SHOULD BE VISIBLE DURING THE INSTALLATION OF AND NORMAL MAINTENANCE OF THE INFRASTRUCTURE.

LABELS SHOULD BE RESISTANT TO THE ENVIRONMENTAL CONDITIONS AT THE POINT OF INSTALLATION (SUCH AS MOISTURE, HEAT, OR ULTRAVIOLET LIGHT), AND SHOULD HAVE A DESIGN LIFE EQUAL TO OR GREATER THAN THAT OF THE LABELED COMPONENT.

LABELS ARE GENERALLY OF EITHER THE ADHESIVE OR INSERT TYPE. ALL LABELS MUST BE LEGIBLE, RESISTANT TO DEFACEMENT, AND MAINTAIN ADHESION TO THE APPLICATION SURFACE.

OUTSIDE PLANT LABELS SHALL BE TOTALLY WATERPROOF, EVEN WHEN SUBMERGED.

LABELS APPLIED DIRECTLY TO A CABLE SHALL HAVE A CLEAR VINYL WRAPPING APPLIED OVER THE LABEL AND AROUND THE CABLE TO PERMANENTLY AFFIX THE LABEL.

OTHER TYPES OF LABELS, SUCH AS TIE-ON LABELS, MAY BE USED. HOWEVER, THE LABEL MUST BE APPROPRIATE FOR THE ENVIRONMENT IN WHICH IT IS USED, AND MUST BE USED IN THE MANNER INTENDED BY THE MANUFACTURER.

MECHANICAL GENERATION

1. ALL LABELS SHALL BE PRINTED OR GENERATED BY A MECHANICAL DEVICE.

2. HAND WRITTEN LABELS ARE NOT ACCEPTABLE.

END OF SECTION

2.X BONDING ACCESSORIES

QUALITY ASSURANCE

ALL CABLE AND EQUIPMENT SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER. ALL METHODS OF CONSTRUCTION THAT ARE NOT SPECIFICALLY DESCRIBED OR INDICATED IN THE CONTRACT DOCUMENTS SHALL BE SUBJECT TO THE CONTROL AND APPROVAL OF THE OWNER OR OWNER REPRESENTATIVE. EQUIPMENT AND MATERIALS SHALL BE OF THE QUALITY AND MANUFACTURE INDICATED. THE EQUIPMENT SPECIFIED IS BASED UPON THE ACCEPTABLE MANUFACTURERS LISTED. WHERE "APPROVED EQUAL" IS STATED, EQUIPMENT SHALL BE EQUIVALENT IN EVERY WAY TO THAT OF THE EQUIPMENT SPECIFIED AND SUBJECT TO APPROVAL.

SUBMITTALS

PROVIDE PRODUCT DATA FOR THE FOLLOWING:

MANUFACTURERS CUT SHEETS, SPECIFICATIONS, AND INSTALLATION INSTRUCTIONS FOR ALL PRODUCTS.

PRODUCTS

BELOW GRADE:

EXOTHERMIC-WELDED TYPE CONNECTORS.

ABOVE GRADE:

BONDING JUMPERS: COMPRESSION TYPE CONNECTORS, USING ZINC-PLATED FASTENERS AND EXTERNAL TOOTH LOCK WASHERS.

GROUND BUSBAR: TWO-HOLE COMPRESSION TYPE LUGS USING TIN-PLATED COPPER OR COPPER ALLOY BOLTS AND NUTS.

RACK AND CABINET GROUND BARS: ONE-HOLE COMPRESSION-TYPE LUGS USING ZINC PLATED OR COPPER ALLOY FASTENERS.

CABLE SHIELDS: MAKE GROUND CONNECTIONS TO MULTI-PAIR COMMUNICATIONS CABLES WITH METALLIC SHIELDS USING SHIELD BONDING CONNECTORS WITH SCREW STUD CONNECTION.

GROUNDING CONDUCTOR SPLICES SHALL BE JOINED WITH MECHANICAL CRIMPED SLEEVE DESIGNED TO HAVE TWO CRIMPS PER SIDE WITH PROPER INDENTS MARKINGS. CRIMP SLEEVES SHALL BE COPPER ALLOY.

GROUNDING CONDUCTOR SHALL BE TERMINATED WITH A MECHANICAL CRIMPED TYPE LUG DESIGNED TO HAVE TWO CRIMPS, SPADE SECTION OF HAVE TWO BOLTS AND MADE OF COPPER ALLOY.

TWO MOUNTING HOLE GROUND TERMINAL BLOCK

GROUND TERMINAL BLOCK SHALL BE MADE OF ELECTROPLATED TIN ALUMINUM EXTRUSION.

GROUND TERMINAL BLOCK SHALL ACCEPT CONDUCTORS RANGING FROM #14 AWG THROUGH 2/0.

THE CONDUCTORS SHALL BE HELD IN PLACE BY TWO STAINLESS STEEL SET SCREWS.

GROUND TERMINAL BLOCK SHALL HAVE TWO 1/4" (6.4 MM) HOLES SPACED ON 5/8" (15.8 MM) CENTERS TO ALLOW SECURE TWO-BOLT ATTACHMENT TO THE RACK OR CABINET.

GROUND TERMINAL BLOCK SHALL BE UL LISTED AS A WIRE CONNECTOR.

COMPRESSION LUGS

COMPRESSION LUGS SHALL BE MANUFACTURED FROM ELECTROPLATED TINNED COPPER.

COMPRESSION LUGS SHALL HAVE TWO HOLES SPACED ON 5/8" OR 1" CENTERS, AS STATED BELOW, TO ALLOW SECURE TWO BOLT CONNECTIONS TO BUSBARS.

COMPRESSION LUGS SHALL BE SIZED TO FIT A SPECIFIC SIZE CONDUCTOR, SIZES #6 TO 4/0, AS STATED BELOW.

COMPRESSION LUGS SHALL BE UL LISTED AS WIRE CONNECTORS.

C-TYPE, COMPRESSION TAPS

COMPRESSION TAPS SHALL BE MANUFACTURED FROM COPPER ALLOY.

COMPRESSION TAPS SHALL BE C-SHAPED CONNECTORS THAT WRAP AROUND TWO CONDUCTORS FORMING AN IRREVERSIBLE SPLICE AROUND THE CONDUCTORS; INSTALLATION REQUIRES A HYDRAULIC CRIMPING TOOL.

COMPRESSION TAPS SHALL BE SIZED TO FIT SPECIFIC SIZE CONDUCTORS, SIZES #2 AWG TO 4/0, AS STATED BELOW.

COMPRESSION TAPS SHALL BE UL LISTED.

PIPE CLAMP WITH GROUNDING CONNECTOR

PIPE CLAMP SHALL BE MADE FROM ELECTROPLATED TINNED BRONZE. INSTALLATION HARDWARE WILL BE STAINLESS STEEL.

PIPE CLAMP SHALL BE SIZED TO FIT UP TO TWO CONDUCTORS RANGING IN SIZE FROM #6 TO 250 ; CONDUCTORS MUST BE THE SAME SIZE.

PIPE CLAMP INSTALLATION HARDWARE SHALL BE SIZED TO ATTACH TO PIPES, SIZES 1" TO 6" (.75" TO 6.63" IN DIAMETER), AS STATED BELOW.

PIPE CLAMP SHALL BE UL LISTED AS GROUNDING AND BONDING EQUIPMENT.

EQUIPMENT GROUND JUMPER KIT

KIT INCLUDES ONE 24" L INSULATED GROUND JUMPER WITH A STRAIGHT TWO HOLE COMPRESSION LUG ON ONE END AND AN L-SHAPED TWO HOLE COMPRESSION LUG ON THE OTHER END, TWO PLATED INSTALLATION SCREWS, AN ABRASIVE PAD AND A .5 ONCE TUBE OF ANTIOXIDANT JOINT COMPOUND.

GROUND CONDUCTOR IS AN INSULATED GREEN/YELLOW STRIPE #6 AWG WIRE.

LUGS ARE MADE FROM ELECTROPLATED TINNED COPPER AND HAVE TWO MOUNTING HOLES SPACES .5" TO .625" APART THAT ACCEPT 1/4" SCREWS.

THE JUMPER WILL BE MADE WITH UL LISTED COMPONENTS.

APPROVED MANUFACTURERS:

COOPER BLINE, BURNDY, OR APPROVED EQUAL.

2.X BONDING CONDUCTORS

CABLE TRAY BONDING CONDUCTOR

GREEN # 6 AWG INSULATED BONDING JUMPER WITH APPROPRIATE LUGS OR MANUFACTURED BRAIDED COPPER GROUNDING JUMPER EQUAL TO A # 6 AWG CABLE.

EQUIPMENT FAME BONDING CONDUCTOR

BONDING CONDUCTOR SHALL BE RUN NEATLY AND UNIFORMLY TO THE EQUIPMENT, RACKS, AND TRAYS.

BONDING CONDUCTOR (BC)

GREEN INSULATED COPPER BONDING CONDUCTOR, SIZE AS REQUIRED BY .

THE BC SHALL BE, AS A MINIMUM, THE SAME AS THE TBB.

BARE CONDUCTORS ARE ACCEPTABLE WHERE PLENUM OR EXPOSED AREAS LIMIT THE USE OF INSULATED CONDUCTORS.

TELECOMMUNICATIONS BONDING BACKBONE (TBB)

GREEN INSULATED COPPER CONDUCTOR, MINIMUM AS SPECIFIED IN THE TABLE BELOW, SIZE 6 AWG. THE TBB SHALL BE SIZED AT 2 KCMIL PER LINEAR FOOT OF CONDUCTOR LENGTH. INSULATION SHALL MEET FIRE RATINGS OF ITS PATHWAY.

TABLE 1 – CONDUCTOR SIZING

2.X GROUND RODS

COPPER CLAD STEEL, 3/4-INCH DIAMETER BY 10 FEET LONG, CONFORMING TO UL 467.

EXECUTION

INSTALLATION

OUTDOOR GROUNDING AND BONDING CONNECTIONS.

ALL OUTDOOR GROUNDING AND BONDING (EARTHING) CONNECTIONS SHALL BE ACCOMPLISHED USING EXOTHERMIC WELDING.

PART 3 – EXECUTION

609.01 3.X INSTALLATION

SCOPE OF WORK

GROUNDING ELECTRODE SYSTEM

BUSBARS

BONDING ACCESSORIES

QUALITY ASSURANCE

ALL CABLE AND EQUIPMENT SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER. ALL METHODS OF CONSTRUCTION THAT ARE NOT SPECIFICALLY DESCRIBED OR INDICATED IN THE CONTRACT DOCUMENTS SHALL BE SUBJECT TO THE CONTROL AND APPROVAL OF THE OWNER OR OWNER REPRESENTATIVE. EQUIPMENT AND MATERIALS SHALL BE OF THE QUALITY AND MANUFACTURE INDICATED. THE EQUIPMENT SPECIFIED IS BASED UPON THE ACCEPTABLE MANUFACTURERS LISTED. WHERE "APPROVED EQUAL" IS STATED, EQUIPMENT SHALL BE EQUIVALENT IN EVERY WAY TO THAT OF THE EQUIPMENT SPECIFIED AND SUBJECT TO APPROVAL.

SUBMITTALS

PROVIDE PRODUCT DATA FOR THE FOLLOWING:

PRODUCTS

GROUNDING ELECTRODE SYSTEM

GROUNDING ELECTRODE SYSTEM

WHEN REQUIRED THE GROUNDING ELECTRODE SYSTEM SHALL MEET THE FOLLOWING

ACTIVE GROUNDING SYSTEM CONSTANTLY REPLENISHING MOISTURE INTO THE SOIL

PROVIDE LOW RESISTANCE TO GROUND

PROVIDE SEASON TO SEASON STABILITY

BE MAINTENANCE-FREE FOR 30 YEARS

CONTAIN NO HAZARDOUS MATERIALS OR CHEMICALS.

APPROVED MANUFACTURERS:

COOPER BLINE, BURNDY, OR APPROVED EQUAL.

WALL-MOUNT BUSBARS

TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB) SHALL BE CONSTRUCTED OF .25" (6.4 MM) THICK SOLID COPPER BAR.

THE BUSBAR SHALL BE 4" (100 MM) HIGH AND 20" (510 MM) LONG AND SHALL HAVE 30 ATTACHMENT POINTS (TWO ROWS OF 15 EACH) FOR TWO-HOLE GROUNDING LUGS.

THE HOLE PATTERN FOR ATTACHING GROUNDING LUGS SHALL MEET THE REQUIREMENTS OF -J- – 607-A AND SHALL ACCEPT 27 LUGS WITH 5/8" (15.8 MM) HOLE CENTERS AND 3 LUGS WITH 1" (25.4) MM) HOLE CENTERS.

THE BUSBAR SHALL INCLUDE WALL-MOUNT STAND-OFF BRACKETS, ASSEMBLY SCREWS AND INSULATORS CREATING A 4" (100 MM) STANDOFF FROM THE WALL.

THE BUSBAR SHALL BE UL LISTED AS GROUNDING AND BONDING EQUIPMENT.

APPROVED MANUFACTURES:

CHATSWORTH (), ERICO CADDY, COOPER BLINE, OR APPROVED EQUAL

TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)

TELECOMMUNICATIONS GROUNDING BUSBAR (TGB) SHALL BE CONSTRUCTED OF .25" (6.4 MM) THICK SOLID COPPER BAR.

THE BUSBAR SHALL BE 2" (50 MM) HIGH AND 12" (300 MM) LONG AND SHALL HAVE 9 ATTACHMENT POINTS (ONE ROW) FOR TWO-HOLE GROUNDING LUGS.

THE HOLE PATTERN FOR ATTACHING GROUNDING LUGS SHALL MEET THE REQUIREMENTS OF -J- – 607-A AND SHALL ACCEPT 6 LUGS WITH 5/8" (15.8 MM) HOLE CENTERS AND 3 LUGS WITH 1" (25.4 MM) HOLE CENTERS.

THE BUSBAR SHALL INCLUDE WALL-MOUNT STAND-OFF BRACKETS, ASSEMBLY SCREWS AND INSULATORS CREATING A 4" (100 MM) STANDOFF FROM THE WALL.

THE BUSBAR SHALL BE UL LISTED AS GROUNDING AND BONDING EQUIPMENT.

APPROVED MANUFACTURES:

CHATSWORTH (), ERICO CADDY, COOPER BLINE, OR APPROVED EQUAL

BONDING ACCESSORIES

BELOW GRADE:

EXOTHERMIC-WELDED TYPE CONNECTORS.

ABOVE GRADE:

BONDING JUMPERS: COMPRESSION TYPE CONNECTORS, USING ZINC-PLATED FASTENERS AND EXTERNAL TOOTH LOCK WASHERS.

GROUND BUSBAR: TWO-HOLE COMPRESSION TYPE LUGS USING TIN-PLATED COPPER OR COPPER ALLOY BOLTS AND NUTS.

RACK AND CABINET GROUND BARS: ONE-HOLE COMPRESSION-TYPE LUGS USING ZINC PLATED OR COPPER ALLOY FASTENERS.

CABLE SHIELDS: MAKE GROUND CONNECTIONS TO MULTI-PAIR COMMUNICATIONS CABLES WITH METALLIC SHIELDS USING SHIELD BONDING CONNECTORS WITH SCREW STUD CONNECTION.

GROUNDING CONDUCTOR SPLICES SHALL BE JOINED WITH MECHANICAL CRIMPED SLEEVE DESIGNED TO HAVE TWO CRIMPS PER SIDE WITH PROPER INDENTS MARKINGS. CRIMP SLEEVES SHALL BE COPPER ALLOY.

GROUNDING CONDUCTOR SHALL BE TERMINATED WITH A MECHANICAL CRIMPED TYPE LUG DESIGNED TO HAVE TWO CRIMPS, SPADE SECTION OF HAVE TWO BOLTS AND MADE OF COPPER ALLOY.

TWO MOUNTING HOLE GROUND TERMINAL BLOCK

GROUND TERMINAL BLOCK SHALL BE MADE OF ELECTROPLATED TIN ALUMINUM EXTRUSION.

GROUND TERMINAL BLOCK SHALL ACCEPT CONDUCTORS RANGING FROM #14 AWG THROUGH 2/0.

THE CONDUCTORS SHALL BE HELD IN PLACE BY TWO STAINLESS STEEL SET SCREWS.

GROUND TERMINAL BLOCK SHALL HAVE TWO 1/4" (6.4 MM) HOLES SPACED ON 5/8" (15.8 MM) CENTERS TO ALLOW SECURE TWO-BOLT ATTACHMENT TO THE RACK OR CABINET.

GROUND TERMINAL BLOCK SHALL BE UL LISTED AS A WIRE CONNECTOR.

COMPRESSION LUGS

COMPRESSION LUGS SHALL BE MANUFACTURED FROM ELECTROPLATED TINNED COPPER.

COMPRESSION LUGS SHALL HAVE TWO HOLES SPACED ON 5/8" OR 1" CENTERS, AS STATED BELOW, TO ALLOW SECURE TWO BOLT CONNECTIONS TO BUSBARS.

COMPRESSION LUGS SHALL BE SIZED TO FIT A SPECIFIC SIZE CONDUCTOR, SIZES #6 TO 4/0, AS STATED BELOW.

COMPRESSION LUGS SHALL BE UL LISTED AS WIRE CONNECTORS.

C-TYPE, COMPRESSION TAPS

COMPRESSION TAPS SHALL BE MANUFACTURED FROM COPPER ALLOY.

COMPRESSION TAPS SHALL BE SIZED TO FIT SPECIFIC SIZE CONDUCTORS, SIZES #2 AWG TO 4/0, AS STATED BELOW.

COMPRESSION TAPS SHALL BE UL LISTED.

PIPE CLAMP WITH GROUNDING CONNECTOR

PIPE CLAMP SHALL BE SIZED TO FIT UP TO TWO CONDUCTORS RANGING IN SIZE FROM #6 TO 250 ; CONDUCTORS MUST BE THE SAME SIZE.

PIPE CLAMP SHALL BE UL LISTED AS GROUNDING AND BONDING EQUIPMENT.

EQUIPMENT GROUND JUMPER KIT

GROUND CONDUCTOR IS AN INSULATED GREEN/YELLOW STRIPE #6 AWG WIRE.

LUGS ARE MADE FROM ELECTROPLATED TINNED COPPER AND HAVE TWO MOUNTING HOLES SPACES .5" TO .625" APART THAT ACCEPT 1/4" SCREWS.

THE JUMPER WILL BE MADE WITH UL LISTED COMPONENTS.

APPROVED MANUFACTURERS:

COOPER BLINE, BURNDY, OR APPROVED EQUAL.

BONDING CONDUCTORS

CABLE TRAY BONDING CONDUCTOR

GREEN # 6 AWG INSULATED BONDING JUMPER WITH APPROPRIATE LUGS OR MANUFACTURED BRAIDED COPPER GROUNDING JUMPER EQUAL TO A # 6 AWG CABLE.

EQUIPMENT FAME BONDING CONDUCTOR

BONDING CONDUCTOR SHALL BE RUN NEATLY AND UNIFORMLY TO THE EQUIPMENT, RACKS, AND TRAYS.

BONDING CONDUCTOR (BC)

GREEN INSULATED COPPER BONDING CONDUCTOR, SIZE AS REQUIRED BY .

THE BC SHALL BE, AS A MINIMUM, THE SAME AS THE TBB.

BARE CONDUCTORS ARE ACCEPTABLE WHERE PLENUM OR EXPOSED AREAS LIMIT THE USE OF INSULATED CONDUCTORS.

TELECOMMUNICATIONS BONDING BACKBONE (TBB)

GREEN INSULATED COPPER CONDUCTOR, MINIMUM AS SPECIFIED IN THE TABLE BELOW, SIZE 6 AWG. THE TBB SHALL BE SIZED AT 2 KCMIL PER LINEAR FOOT OF CONDUCTOR LENGTH. INSULATION SHALL MEET FIRE RATINGS OF ITS PATHWAY.

TABLE 1 – CONDUCTOR SIZING

GROUND RODS

COPPER CLAD STEEL, 3/4-INCH DIAMETER BY 10 FEET LONG, CONFORMING TO UL 467.

EXECUTION

OUTDOOR GROUNDING AND BONDING CONNECTIONS.

ALL OUTDOOR GROUNDING AND BONDING (EARTHING) CONNECTIONS SHALL BE ACCOMPLISHED USING EXOTHERMIC WELDING.

WALL-MOUNT BUSBARS

CONDUCTOR CONNECTIONS TO THE TMGB OR TGB SHALL BE MADE WITH TWO-HOLE BOLT-ON COMPRESSION LUGS SIZED TO FIT THE BUSBAR AND THE CONDUCTORS.

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.

THE WALL-MOUNT BUSBAR SHALL BE BONDED TO GROUND AS PART OF THE OVERALL TELECOMMUNICATIONS BONDING AND GROUNDING SYSTEM.

RACK-MOUNT BUSBARS AND GROUND BARS

WHEN A RACK OR CABINET SUPPORTS ACTIVE EQUIPMENT OR ANY TYPE OF SHIELDED CABLE OR CABLE TERMINATION DEVICE REQUIRING A GROUND CONNECTION, ADD A RACK-MOUNT HORIZONTAL OR VERTICAL BUSBAR OR GROUND BAR TO THE RACK OR CABINET. THE RACK-MOUNT BUSBAR OR GROUND BAR PROVIDES MULTIPLE BONDING POINTS ON THE RACK FOR RACK AND RACK-MOUNT EQUIPMENT.

BOND THE RACK-MOUNT BUSBAR OR GROUND BAR TO THE ROOM'S TMGB OR TGB WITH APPROPRIATELY SIZED HARDWARE AND CONDUCTOR.

GROUND TERMINAL BLOCK

EVERY RACK AND CABINET SHALL BE BONDED TO THE TMGB OR TGB.

MINIMUM BONDING CONNECTION TO RACKS AND CABINETS SHALL BE MADE WITH A RACK-MOUNT TWO-HOLE GROUND TERMINAL BLOCK SIZED TO FIT THE CONDUCTOR AND RACK AND INSTALLED ACCORDING TO MANUFACTURER RECOMMENDATIONS.

REMOVE PAINT BETWEEN RACK/CABINET AND TERMINAL BLOCK, CLEAN SURFACE AND USE ANTIOXIDANT BETWEEN THE RACK AND THE TERMINAL BLOCK TO HELP PREVENT CORROSION AT THE BOND.

PIPE CLAMP

BOND METAL PIPES LOCATED INSIDE THE DATA CENTER COMPUTER ROOM WITH A MINIMUM #6 AWG CONDUCTOR TO THE TMGB OR TGB USING A PIPE CLAMP SIZED TO FIT THE PIPE AND THE CONDUCTOR AND INSTALLED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS.

REMOVE PAINT BETWEEN THE PIPE AND PIPE CLAMP, CLEAN SURFACE AND USE ANTIOXIDANT BETWEEN THE PIPE AND THE CLAMP TO HELP PREVENT CORROSION AT THE BOND.

REMOVE INSULATION FROM CONDUCTORS WHERE WIRES ATTACH TO THE PIPE CLAMP.

EQUIPMENT GROUND JUMPER KIT

BOND EQUIPMENT TO A VERTICAL RACK-MOUNT BUSBAR OR GROUNDBAR USING GROUND JUMPER ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS.

CLEAN THE SURFACE AND USE ANTIOXIDANT BETWEEN THE COMPRESSION LUGS ON THE JUMPER AND THE RACK-MOUNT BUSBAR OR GROUNDBAR TO HELP PREVENT CORROSION AT THE BOND.

WALL BOXES

RACEWAY

CONDUIT

CONDUIT BUSHINGS

SHOP DRAWINGS:

1. COMPONENT LIST: LIST MANUFACTURER, PART NUMBER, AND QUANTITY OF EACH COMPONENT.

2. INCLUDE DIMENSIONED PLAN AND ELEVATION VIEWS OF EQUIPMENT ROOMS, LABELING EACH INDIVIDUAL COMPONENT. SHOW RACEWAY ASSEMBLIES, METHOD OF FIELD ASSEMBLY, WORKSPACE REQUIREMENTS, AND ACCESS FOR CABLE CONNECTIONS.

PRODUCTS

TELECOM OUTLETS (TO)

CAT6 TO CONSISTS OF ONE (1) " SQUARE BY 2-1/8" DEEP FLUSH MOUNTED BOX. EACH OUTLET BOX SHALL HAVE AN EMT CONDUIT STUBBED ABOVE THE DROP CEILING OR EXTENDED INTO THE HALLWAY CABLE TRAY. CONDUIT SIZE IS AS FOLLOWS UON:

FOR OUTLETS WITH 3 OR LESS CABLES, USE A 1" CONDUIT.

FOR OUTLETS WITH 3-6 CABLES, USE A 1.25" CONDUIT.

FOR ALL OTHER SIZES, CALCULATE THE FILL RATIO AT 40% FOR PROPER SIZED CONDUIT.

CAT6A TO CONSISTS OF ONE (1) 5" SQUARE BY 2-7/8" DEEP FLUSH MOUNTED BOX. EACH OUTLET BOX SHALL HAVE AN EMT CONDUIT STUBBED ABOVE THE DROP CEILING OR EXTENDED INTO THE HALLWAY CABLE TRAY. CONDUIT SIZE IS AS FOLLOWS UON:

FOR OUTLETS WITH 3 OR LESS CABLES, USE A 1.25" CONDUIT.

FOR OUTLETS WITH 3-6 CABLES, USE A TWO 1.25" CONDUIT.

FOR ALL OTHER SIZES, CALCULATE THE FILL RATIO AT 40% FOR PROPER SIZED CONDUIT.

EXISTING THE NEAREST MOUNTED CONSTRUCTION TO TYPICALLY CONSISTS OF SURFACE-MOUNTED RACEWAY INCLUDING BASE, COVER, END FITTING, ENTRANCE END FITTING, AND (2) 1" CONDUITS STUBBED OUT TOP OF ENTRANCE END FITTING TO ABOVE CEILING OR OUT TO NEAREST HALLWAY DISTRIBUTION SYSTEM. SIZE OF THE RACEWAY IS SITE DEPENDENT BASED ON NUMBER OF CONDUCTORS TO BE INSTALLED.

WHERE CEILINGS ARE ACCESSIBLE, THE RACEWAY AND ENTRANCE END FITTING SHALL EXTEND ABOVE THE CEILING AND THE CONDUITS INSTALLED ABOVE THE CEILING IN THE ROOM TO THE NEAREST HALLWAY DISTRIBUTION SYSTEM.

HORIZONTAL DISTRIBUTION SYSTEMS

CONDUIT SYSTEM (RENOVATIONS ONLY, WHERE CONDUIT EXISTS)

4. PROVIDE MEASURED PULL LINE IN EACH CONDUIT RATED AT 1200 LBS. MINIMUM. INCREMENTS MUST BE IN 12" STEPS.

5. GROUNDING OF CONDUITS IS NOT REQUIRED PER #250-33, EXCEPTION NO. 2. SHALL BE PAINTED EXCEPT CONDUIT ABOVE SUSPENDED CEILINGS OR IN MECHANICAL, ELECTRICAL OR TELECOMMUNICATION ROOMS. COLOR TO MATCH THAT OF SURFACE INSTALLED UPON OR AS DIRECTED BY OWNER'S REPRESENTATIVE. COORDINATE WITH OTHER TRADES PRIOR TO PAINTING.

6. PROVIDE RESTORABLE FIRE STOPS INSIDE AND AROUND CONDUITS AS RECOMMENDED BY UL1479 OR E814 FOR ALL CONDUITS PENETRATING FIRE-RATED CONSTRUCTION. FIRE RATED CONSTRUCTION TO BE VERIFIED WITH AHJ. SEE SECTION 27 05 32 FOR MORE FIRESTOPPING INFORMATION.

CORRIDOR CABLE TRAY SYSTEM

SUBMITTAL DRAWINGS, IN THE FORM OF 8 ½"X 11" CATALOG CUT SHEETS, SHALL BE PROVIDED FOR THE FOLLOWING ITEMS: CABLE TRAY, FITTINGS, ACCESSORIES AND LOAD DATA.

CABLE TRAY SHALL NOT BE LOADED BEYOND 60% OF MANUFACTURER'S RECOMMENDED LOAD CAPACITY.

INSTALL WALL MOUNTED CABLE TRAY ON BOTH SIDES OF HALLWAY AS SHOWN ON DRAWINGS AND WHERE APPLICABLE.

WHERE A NEW CABLE TRAY DISTRIBUTION SYSTEM ENCOUNTERS A WALL, INSTALL SUFFICIENT 4" SLEEVES THROUGH THE WALL SO CABLING DOES NOT EXCEED 20% FILL.

WHERE CABLE TRAY IS EXPOSED BELOW CEILING, INSTALL THE APPROPRIATE SOLID BOTTOM INSERTS TO CONCEAL CABLES.

INSTALL CABLE TRAY DROPOUTS WHERE LARGE QUANTITIES OF CABLES EXIT THE DISTRIBUTION SYSTEM.

CABLE TRAY MUST BE SIZED TO FACILITATE SUFFICIENT GROWTH CAPACITY FOR MIGRATION CABLE PLANT TO COEXIST IN SAME TRAY AS EXISTING CABLE PLANT, WHEREVER POSSIBLE.

MANUFACTURER OF CABLE TRAY IN CORRIDORS AND TELECOM ROOMS SHALL BE:

TELECOMMUNICATION ROOM CABLE TRAY SYSTEM

TR CABLE TRAY SHALL COMPLETELY WRAP ALL WALLS WITHIN THE ROOM. CABLE TRAY SHALL EXTEND OVER ALL EQUIPMENT FRAMES.

CABLE TRAY SHALL BE A MINIMUM WIDTH OF 2" HIGH X 12" WIDE. CABLE TRAY MAY BE SIZED UPWARDS IF FILL RATIO REQUIREMENTS NEED TO BE MET BASED ON CABLE QUANTITIES.

MANUFACTURER OF TUBULAR LADDER TYPE CABLE TRAY IN TELECOMMUNICATION ROOMS SHALL BE COOPER BLINE, CHATSWORTH (), COMMSCOPE OR APPROVED EQUAL.

CABLE TRAY SHALL BE 12 INCH CABLE RUNWAY.

RECTANGULAR STEEL TUBING CROSS MEMBERS WELDED AT 12-INCH INTERVALS. FINISH IN BLACK ENAMEL. COMMSCOPE, PART NUMBER CR--10L-12W OR EQUIVALENT.

12-INCH WALL ANGLE ASSEMBLY KIT – COMMSCOPE PART NUMBER CR6-12WRSK OR EQUIVALENT.

3-INCH CHANNEL RACK–TO-RUNWAY MOUNTING PLATE - COMMSCOPE PART NUMBER 2RRMK OR EQUIVALENT.

END CLOSING TUBE - COMMSCOPE PART NUMBER CRPECK OR EQUIVALENT.

CORNER CLAMP - COMMSCOPE PART NUMBER CRTJSK OR EQUIVALENT (2 REQUIRED PER END CLOSING TUBE TO COMPLETE ASSEMBLY).

ALL OPEN PATHWAY/TRAYS SHALL BE INSTALLED A MINIMUM OF SIX (6) INCHES AWAY FROM ANY LIGHT FIXTURE OR OTHER SOURCE OF EMI (ELECTROMAGNETIC INTERFERENCE).

ALL PATHWAYS SHALL BE GROUNDED PER ARTICLE 250.

PROVIDE EXTERNAL GROUNDING STRAP AT EXPANSION JOINTS, SLEEVES, AND CROSSOVER AND AT OTHER LOCATIONS WHERE PATHWAY/TRAY CONTINUITY IS INTERRUPTED.

SUPPORT ALL PATHWAYS FROM BUILDING CONSTRUCTION. DO NOT SUPPORT PATHWAYS FROM DUCTWORK, PIPING, OR EQUIPMENT HANGERS.

INSTALL CABLE TRAY LEVEL AND STRAIGHT UNLESS NOTED ON THE CONSTRUCTION DRAWINGS.

STATION CONDUITS

STATION CONDUIT IS DEFINED AS CONDUIT THAT ORIGINATES AT THE TO AND RISES WITHIN THE WALLS OR IS EXPOSED FROM A RACEWAY AND EXTENDS UP INTO THE DROP CEILING OR OVER TO THE HALLWAY DISTRIBUTION SYSTEM.

PROVIDE AN INSULATING PRESS FIT BUSHING ON ALL TELECOMMUNICATIONS CONDUITS INCLUDING INTERCONNECTING NIPPLES AND STUB TO DISTRIBUTION SYSTEM. TO PREVENT CONFLICTS WITH OTHER CABLES OR CONDUITS TO CABLE TRAY, THE CONDUIT SHALL BE STUBBED NOT LESS THAN 6" ABOVE OR BELOW CONDUIT/CABLE TRAY CENTER LINE. WHERE SPACE PERMITS, EVERY EFFORT SHALL BE MADE TO BEND STATION CONDUITS DOWN SUCH THAT THE FLOW OF INSTALLED CABLES PROMOTES THE MINIMUM LENGTH BACK TO THE TR AND THE LEAST NUMBER OF BENDS IN THE CABLES. BUSHINGS MUST BE RATED TO BE USED IN AN ENVIRONMENTAL AIR HANDLING SPACE (PLENUM).

MANUFACTURER OF INSULATING BUSHING ON ALL TELECOMMUNICATION CONDUITS SHALL BE:

ARLINGTON, ERICO CADDY OR EQUIVALENT

PROVIDE PULL LINE IN EACH EMPTY CONDUIT TO HALLWAY DISTRIBUTION SYSTEM.

INDELIBLY MARK THE STATION CONDUIT AT HALLWAY DISTRIBUTION END WITH ROOM # THAT CONDUIT SERVES.

THE USE OF 90 DEGREE ELECTRICAL PULLING ELBOWS IS PROHIBITED.

PLACE AN APPROPRIATELY SIZED JUNCTION BOX IN EACH INDIVIDUAL STATION CONDUIT RUN THAT EXCEEDS 100 FEET IN LENGTH.

THE USE OF A THIRD BEND IN A CONDUIT IS ONLY ACCEPTABLE IF:

THE TOTAL CONDUIT RUN IS REDUCED BY 15%.

THE CONDUIT SIZE IS INCREASED TO THE NEXT TRADE SIZE.

ONE OF THE BENDS IS LOCATED WITHIN 12” OF THE CABLE FEED END.

JUNCTION BOX REQUIREMENTS FOR STATION CONDUITS

IF THE STATION CONDUIT ROUTE EXCEEDS THE 180 DEGREE OF TOTAL BENDS LIMITATION, AN APPROPRIATELY SIZED JUNCTION BOX IS REQUIRED WITHIN A STRAIGHT SECTION OF THE CONDUIT RUN.

EACH STATION CONDUIT RUN REQUIRES A SEPARATE JUNCTION BOX. THE SHARING OF A JUNCTION BOX BY MULTIPLE CONDUITS IS PROHIBITED.

A JUNCTION BOX SHALL NOT BE USED IN PLACE OF A BEND. ALL JUNCTION BOXES IN STATION CONDUIT PATHS SHALL BE INSTALLED WITHIN A STRAIGHT SECTION OF THE CONDUIT RUN.

SERVICE ENTRANCE CONDUITS

ENTRANCE CONDUITS SHALL BE CONTINUOUS INTO THE BUILDING AND TO THE ER. SECURELY FASTEN ALL ENTRANCE CONDUITS TO THE BUILDING TO WITHSTAND ANY CABLE PLACING OPERATION. DO NOT INCLUDE MORE THAN TWO 90-DEGREE BENDS BETWEEN PULLING POINTS WHEN INSTALLING ENTRANCE CONDUITS.

ON EXTERIOR WALL PENETRATIONS, SEAL BOTH SIDES OF THE WALL AROUND OUTSIDE OF CONDUIT WITH HYDRAULIC CEMENT TO PREVENT WATER FROM ENTERING THE BUILDING. SEAL THE INSIDE OF THE CONDUIT ON BOTH SIDES WITH CONDUIT PLUGS, WATER PLUGS, OR DUCT SEALER TO PREVENT WATER, VAPORS, OR GASES FROM ENTERING THE BUILDING.

PATHWAY REQUIREMENTS FOR ENTRANCE CONDUITS

IF THE ENTRANCE CONDUITS EXCEED THE 180 DEGREE OF TOTAL BENDS LIMITATION, AN APPROPRIATE SIZED JUNCTION BOX, MANHOLE, OR HANDHOLE IS REQUIRED.

AS-BUILT DRAWINGS OF ENTRANCE CONDUIT PATH REQUIRED TO BE SUBMITTED TO OWNER'S REPRESENTATIVE BEFORE COVERED WITH SOIL.

RISER CONDUITS

RISER CONDUITS SHALL ONLY BE USED WHEN NOTED ON THE CONSTRUCTION DOCUMENTS FOR SPECIAL APPLICATIONS ONLY. RISER CONDUITS ARE NOT REQUIRED AS A GENERAL RULE FOR THE RISER SYSTEM. HOWEVER, WHEN REQUIRED:

A MINIMUM OF (2) 4" CONDUITS SHALL BE INSTALLED BETWEEN THE ER ROOM AND EACH TR ROOM AS SHOWN ON THE DRAWINGS.

CONDUITS ENTERING ER AND TR ROOMS SHALL BE REAMED OR BUSHED AND TERMINATED NOT MORE THAN 4" FROM ENTRANCE WALL AND WITHIN 12" OF ROOM CORNERS.

CONDUITS ENTERING ER AND TR ROOMS FROM BELOW FLOOR SHALL BE TERMINATED NOT MORE THAN 4" ABOVE FINISHED FLOOR.

CONDUITS FOR RISER CABLES SHALL BE CONTINUOUS AND SEPARATE FROM ALL OTHER CONDUIT OR ENCLOSED RACEWAY SYSTEMS. DO NOT INCLUDE MORE THAN TWO 90 DEGREE BENDS BETWEEN PULLING POINTS WHEN INSTALLING RISER CONDUITS. WHERE JUNCTION BOXES ARE REQUIRED, LOCATE IN ACCESSIBLE AREAS, SUCH AS ABOVE SUSPENDED CEILINGS IN HALLWAYS.

CONDUITS SHALL NOT BE LESS THAN 4" TRADE SIZE AND BE EQUIPPED WITH A MEASURED PULL LINE AT 12" INCREMENTS RATED AT A MINIMUM 1200-POUND TEST.

PROVIDE RESTORABLE FIRE STOPS INSIDE AND AROUND CONDUITS AS RECOMMENDED BY UL1479 OR E814 FOR ALL CONDUITS PENETRATING FIRE-RATED CONSTRUCTION. FIRE-RATED CONSTRUCTION TO BE VERIFIED WITH AHJ. SEE SECTION 27 05 32 FOR MORE FIRESTOPPING INFORMATION.

PROVIDE AN INSULATING PRESS FIT BUSHING ON ALL TELECOMMUNICATIONS RISER CONDUITS. BUSHINGS MUST BE RATED TO BE USED IN AN ENVIRONMENTAL AIR HANDLING SPACE (PLENUM).

THE MANUFACTURER OF INSULATING BUSHING ON ALL TELECOMMUNICATION CONDUITS SHALL BE ARLINGTON OR EQUAL.

RISER CONDUITS SHALL NOT BE USED FOR THE DISTRIBUTION OF HORIZONTAL CABLES.

FIRESTOPPING

IN ALL BUILDINGS, FLOOR/CEILING ASSEMBLIES, STAIRS, AND ELEVATOR PENETRATIONS MUST BE SEALED WITH A 2-HOUR FIRE STOP ASSEMBLY AT A MINIMUM, UNLESS OTHERWISE NOTED.

CONTACT OWNER'S REPRESENTATIVE TO IDENTIFY WALLS WHICH ARE FIRE-RATED CONSTRUCTION. WALLS MUST BE SEALED WITH A 2-HOUR FIRE STOP ASSEMBLY AT A MINIMUM.

COMMUNICATION PATHWAYS REQUIRING FIRE STOPPING SHALL UTILIZE REMOVABLE/RE-USABLE FIRE STOPPING PUTTIES FOR EASE OF MOVES, ADDS, AND CHANGES.

ALL FIRE STOPPING PENETRATIONS SHALL CONFORM TO THE RECOMMENDED PRACTICES LISTED IN UL1479 OR .

EXAMINATION

INSTALL CABLE MANAGEMENT SYSTEM AT LOCATIONS INDICATED ON THE DRAWINGS AND IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

SUBMITTALS

A. SUBMIT PRODUCT DATA ON NON-CONTINUOUS CABLE SUPPORT DEVICES, INCLUDING ATTACHMENT METHODS. PRODUCT DATA TO INCLUDE, BUT NOT LIMITED TO MATERIALS, FINISHES, APPROVALS, LOAD RATINGS, AND DIMENSIONAL INFORMATION.

QUALITY ASSURANCE

A. NON-CONTINUOUS CABLE SUPPORTS, AND CABLE SUPPORT ASSEMBLIES SHALL BE LISTED BY UNDERWRITERS LABORATORIES FOR BOTH CANADIAN AND US STANDARDS (CULUS).

B. NON-CONTINUOUS CABLE SUPPORTS SHALL HAVE THE MANUFACTURER'S NAME AND PART NUMBER STAMPED ON THE PART FOR IDENTIFICATION.

COORDINATION

PRODUCTS

ACCEPTABLE MANUFACTURERS

A. SUBJECT TO COMPLIANCE WITH THESE SPECIFICATIONS, NON-CONTINUOUS CABLE SUPPORTS SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

NON-CONTINUOUS CABLE SUPPORT SYSTEMS

A. NON-CONTINUOUS CABLE SUPPORTS

1. NON-CONTINUOUS CABLE SUPPORTS SHALL PROVIDE A BEARING SURFACE OF SUFFICIENT WIDTH TO COMPLY WITH REQUIRED BEND RADII OF HIGH-PERFORMANCE CABLES; CULUS LISTED.

2. NON-CONTINUOUS CABLE SUPPORTS SHALL HAVE FLARED EDGES TO PREVENT DAMAGE WHILE INSTALLING CABLES.

3. NON-CONTINUOUS CABLE SUPPORTS SIZED 1 5/16" AND LARGER SHALL HAVE A CABLE RETAINER STRAP TO PROVIDE CONTAINMENT OF CABLES WITHIN THE HANGER. THE CABLE RETAINER STRAP SHALL BE REMOVABLE AND REUSABLE AND BE SUITABLE FOR USE IN AIR HANDLING SPACES.

4. NON-CONTINUOUS CABLE SUPPORTS SHALL HAVE AN ELECTRO-GALVANIZED OR G60 FINISH AND SHALL BE RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS.

5. STAINLESS STEEL NON-CONTINUOUS CABLE SUPPORTS ARE INTENDED FOR INDOOR AND OUTDOOR USE IN NON-CORROSIVE ENVIRONMENTS OR WHERE ONLY MILDLY CORROSIVE CONDITIONS APPLY.

6. NON-CONTINUOUS CABLE SUPPORTS SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

B. ADJUSTABLE NON-CONTINUOUS CABLE SUPPORT SLING

1. CONSTRUCTED FROM STEEL AND WOVEN LAMINATE; SLING LENGTH CAN BE ADJUSTED TO HOLD UP TO 425 4-PAIR UTP; RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS. RATED TO SUPPORT CATEGORY 5E AND HIGHER CABLE, OR OPTICAL FIBER CABLE; CULUS LISTED.

2. ADJUSTABLE NON-CONTINUOUS CABLE SUPPORT SLING SHALL HAVE A STATIC LOAD LIMIT OF 100 LBS.

3. ADJUSTABLE NON-CONTINUOUS CABLE SUPPORT SLING SHALL BE SUITABLE FOR USE IN AIR HANDLING SPACES.

4. IF REQUIRED, ASSEMBLE TO MANUFACTURER RECOMMENDED SPECIALTY FASTENERS INCLUDING BEAM CLIPS, FLANGE CLIPS, C AND Z PURLIN CLIPS.

5. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

C. MULTI-TIERED NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES

1. MULTI-TIERED NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES SHALL BE USED WHERE SEPARATE CABLING COMPARTMENTS ARE REQUIRED. ASSEMBLIES MAY BE FACTORY ASSEMBLED OR ASSEMBLED FROM PRE-PACKAGED KITS. ASSEMBLIES SHALL CONSIST OF A STEEL ANGLED HANGER BRACKET HOLDING UP TO SIX NON-CONTINUOUS CABLE SUPPORTS, RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS; CULUS LISTED.

2. IF REQUIRED, THE MULTI-TIER SUPPORT BRACKET MAY BE ASSEMBLED TO MANUFACTURER RECOMMENDED SPECIALTY FASTENERS INCLUDING BEAM CLAMPS, FLANGE CLIPS, C AND Z PURLIN CLIPS.

3. THE MULTI-TIERED SUPPORT BRACKET SHALL CONSIST OF:

D. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM TEE BAR

1. TEE BAR SUPPORT BRACKET WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED; RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS; CULUS LISTED.

2. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

E. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM DROP WIRE/CEILING

1. FASTENER TO WIRE/ROD WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED; RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS; CULUS LISTED.

2. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

F. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM BEAM, FLANGE

1. FASTENER TO BEAM OR FLANGE WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED; RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS; CULUS LISTED.

2. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

G. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM C & Z PURLIN

1. FASTENER TO C OR Z PURLIN WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED; RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS, CULUS LISTED.

2. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

H. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM WALL, CONCRETE, OR JOIST

1. FASTENER TO WALL, CONCRETE, OR JOIST WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED; RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS, CULUS LISTED.

2. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

I. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM THREADED ROD

1. FASTENER TO THREADED ROD WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED, RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS, CULUS LISTED.

2. THE MULTI-TIERED SUPPORT BRACKET SHALL HAVE A STATIC LOAD LIMIT OF 300 LBS.

3. U-HOOKS AND DOUBLE J-HOOK SHALL ATTACH DIRECTLY TO THREADED ROD USING STANDARD NUTS.

4. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

J. RAISED FLOOR NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES

1. FASTENER TO RAISED (ACCESS) FLOOR PEDESTAL WITH ONE NON-CONTINUOUS CABLE SUPPORT, FACTORY OR JOBSITE ASSEMBLED, RATED FOR INDOOR USE IN NON-CORROSIVE ENVIRONMENTS; CULUS LISTED.

2. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

K. CANTILEVER-MOUNTED CABLE SUPPORTS

1. U-HOOK SHALL BE ABLE TO BE ASSEMBLED TO A WIDE VARIETY OF WALL MOUNT BRACKETS.

2. SPACING OF INDIVIDUAL U-HOOKS AS NEEDED, MAX OF 4' TO 5' APART.

3. U-HOOKS MAY HAVE THE OPTIONAL ATTACHMENT OF A CABLE ROLLER FOR EASE IN PULLING CABLES.

4. MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

CABLE PULLEY

THE PIN AND ROLLER ASSEMBLY MUST BE REMOVED AFTER CABLES ARE INSTALLED.

MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

CABLE PROTECTOR

THE PROTECTIVE STEEL TUBE SHALL FIT OVER THREADED ROD AND BE AT LEAST 4" IN LENGTH.

THE TUBE SHALL PREVENT DAMAGE TO CABLES PLACED IN OR PULLED THROUGH -CMTM U-HOOKS. THE TUBE SHALL NOT INHIBIT THE PULLING OF CABLES.

MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

FINISHES

A. B633 STANDARD SPECIFICATION FOR ELECTRO-DEPOSITED COATINGS OF ZINC ON IRON AND STEEL

B 695 STANDARD SPECIFICATION FOR COATINGS OF ZINC MECHANICALLY DEPOSITED ON IRON AND STEEL

A123 STANDARD SPECIFICATION FOR ZINC (HOT-DIP GALVANIZED) COATINGS ON IRON AND STEEL PRODUCTS

A924/A924M STANDARD SPECIFICATION FOR GENERAL REQUIREMENTS FOR STEEL SHEET, METALLIC-COATED BY THE HOT-DIP PROCESS

B. NON-CONTINUOUS CABLE SUPPORTS USED WHERE ONLY MILDLY CORROSIVE CONDITIONS APPLY SHALL BE STAINLESS STEEL, AISI TYPE 304.

EXECUTION

B. DO NOT EXCEED LOAD RATINGS SPECIFIED BY MANUFACTURER.

C. ADJUSTABLE NON-CONTINUOUS SUPPORT SLING SHALL HAVE A STATIC LOAD LIMIT OF 100 LBS.

D. FOLLOW MANUFACTURER'S RECOMMENDATIONS FOR ALLOWABLE FILL CAPACITY FOR EACH SIZE NON-CONTINUOUS CABLE SUPPORT.

E. LOCATE PATHWAYS PER TELECOMMUNICATIONS DRAWINGS.

PRODUCT DATA: SHALL BE CLEARLY MARKED TO INDICATE ALL TECHNICAL INFORMATION WHICH SPECIFIES FULL COMPLIANCE WITH REQUIREMENTS OF THIS SECTION AND CONTRACT DOCUMENTS, INCLUDING THE FOLLOWING:

1. COPY OF UL ILLUSTRATION OF EACH PROPOSED SYSTEM INDICATING MANUFACTURER'S APPROVED MODIFICATIONS.

QUALITY ASSURANCE

FIRESTOPPING SYSTEMS (MATERIALS AND DESIGN) SHALL CONFORM TO BOTH FLAME (F) RATINGS AND TIME (T) RATINGS AS REQUIRED BY LOCAL BUILDING CODE AND AS TESTED BY NATIONALLY ACCEPTED TEST AGENCIES PER E814 OR UL 1479 FIRE TESTS IN A CONFIGURATION THAT IS REPRESENTATIVE OF FIELD CONDITIONS.

COORDINATION

REVISE LOCATIONS AND ELEVATIONS FROM THOSE INDICATED AS REQUIRED TO SUIT FIELD CONDITIONS AND AS APPROVED BY THE ARCHITECT.

PRODUCTS

ACCEPTABLE MANUFACTURERS:

MATERIALS AND PRODUCTS REQUIRED FOR WORK OF THIS SECTION SHALL NOT CONTAIN ASBESTOS OR POLYCHLORINATED BIPHENYLS (PCB).

MANUFACTURERS: 3M, , & HILTI

GENERAL

CAULKING

WHEN CAULKING IS USED, PROVIDE AND INSTALL FLEXIBLE CAULKING MATERIALS. CURED FIRESTOP MATERIALS 1/8 THICK SHALL BE ABLE AROUND A 1" MANDREL WITHOUT BREAKING.

FIRESTOP

DO NOT USE ANY FIRESTOP PRODUCTS WHICH RE-EMULSIFY, LEACH ACTIVE INTUMESCENT INGREDIENTS OR DISSOLVE WHEN PLACED IN WATER AFTER CURING. PRODUCT MUST WITHSTAND THE PASSAGE OF COLD SMOKE, EITHER AS INHERENT PROPERTY OF THE SYSTEM OR BY THE USE OF A SEPARATE PRODUCT INCLUDED AS PART OF THE UL SYSTEM OR DEVICE AND DESIGNED TO PERFORM THIS FUNCTION.

PENETRATION SEALS

GENERAL:

PENETRATION SEALS (FIRESTOPPING MATERIAL) SHALL BE ASBESTOS-FREE AND CAPABLE OF MAINTAINING AN EFFECTIVE BARRIER AGAINST FLAME, SMOKE AND GASES IN COMPLIANCE WITH REQUIREMENTS OF E814 AND UL 1479.

MATERIALS SHALL MEET AND BE ACCEPTABLE FOR USE BY ALL THREE MODEL BUILDING CODES, BASIC/CALIFORNIA BUILDING CODE, BUILDING CODE AND STANDARD BUILDING CODE, PER NATIONAL EVALUATION SERVICE, INC. REPORT # -243.

MATERIALS SHALL MEET THE REQUIREMENTS OF NFPA 101 AND .

MATERIALS SHALL BE SUITABLE FOR THE FIRESTOPPING OF PENETRATIONS MADE BY STEEL, GLASS, PLASTIC AND INSULATED PIPE, CONDUIT, BUS DUCT, NON-INSULATED PIPE, AND DUCTWORK.

ON INSULATED PIPE, FIRE-RATING CLASSIFICATION MUST NOT REQUIRE REMOVAL OF INSULATION.

THE RATING OF PENETRATION SEALS SHALL NOT BE LESS THAN THE RATING OF THE TIME-RATED FLOOR OR WALL ASSEMBLY.

THE SYSTEMS SHOWN BELOW ARE EXAMPLES AND OTHER EQUAL SYSTEMS MAY BE APPROVED OR REQUIRED BY THE AHJ.

2-HOUR RATED CONCRETE FLOOR:

PENETRANTS: MULTIPLE PIPES.

UL SYSTEM: NO. 93.

2-HOUR RATED CONCRETE FLOOR:

PENETRANTS: MAXIMUM 30" DIA. METAL PIPE/CONDUIT.

UL SYSTEM: NO.319

1-2 –HOUR RATED GYPSUM BOARD WALL:

PENETRANT: METAL PIPE/CONDUIT.

UL SYSTEM: NO. 147

2-HOUR RATED GYPSUM BOARD WALL:

PENETRANT: METAL PIPE/CONDUIT.

UL SYSTEM: NO. 147.

3-HOUR RATED CONCRETE WALL:

PENETRANT: METAL DUCT, MAXIMUM 2' SQUARE AND MAXIMUM DIMENSION OF 30".

UL SYSTEM: NO. 105.

WALLS BELOW GRADE:

PENETRANTS: PIPE SLEEVES.

SEAL: THUNDERLINE “LINK SEAL” CASING SEAL.

EXECUTION

INSPECTION

EXAMINE THE AREAS AND CONDITIONS WHERE FIRESTOPS ARE TO BE INSTALLED AND NOTIFY THE ARCHITECT OF CONDITIONS DETRIMENTAL TO THE PROPER AND TIMELY COMPLETION OF THE WORK. DO NOT PROCEED WITH WORK UNTIL UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED BY THE CONTRACTOR IN A MANNER ACCEPTABLE TO THE ARCHITECT.

CONDITIONS REQUIRING FIRESTOPPING

GENERAL – PROVIDE FIRESTOPPING FOR CONDITIONS SPECIFIED WHETHER OR NOT FIRESTOPPING IS INDICATED, AND IF INDICATED, WHETHER SUCH MATERIAL IS DESIGNED AS INSULATION, SAFING, OR OTHERWISE.

AT ANY POINT WHERE A FIRE RATED WALL IS PENETRATED WITH CABLE OR CONDUIT.

PENETRATIONS

1. PENETRATIONS INCLUDE CONDUIT, CABLE WIRE, PIPE, DUCT OR OTHER ELEMENTS WHICH PASS THROUGH ONE OR BOTH OUTER SURFACES OF A FIRE RATED FLOOR, WALL OR PARTITION.

2. THESE REQUIREMENTS FOR PENETRATIONS SHALL APPLY WHETHER OR NOT SLEEVES HAVE BEEN PROVIDED, AND WHETHER OF NOT PENETRATIONS ARE TO BE EQUIPPED WITH ESCUTCHEONS OR OTHER TRIM. IF PENETRATIONS ARE SLEEVED FIRESTOP ANY ANNULAR SPACE BETWEEN THE SLEEVE AND WALL OPENING.

PROVIDE FIRESTOPPING TO FILL MISCELLANEOUS VOIDS AND OPENINGS IN FIRE-RATED CONSTRUCTION AS SPECIFIED HEREIN.

GENERAL

FIELD QUALITY CONTROL

PREPARE AND INSTALL FIRESTOPPING SYSTEMS IN ACCORDANCE WITH MANUFACTURER’S PRINTED INSTRUCTIONS AND RECOMMENDATIONS.

FOLLOW SAFETY PROCEDURES RECOMMENDED IN THE MATERIAL SAFETY DATA SHEETS.

FINISH SURFACES OF FIRESTOPPING WHICH IS TO REMAIN EXPOSED IN THE COMPLETED WORK TO A UNIFORM AND LEVEL CONDITION.

ALL AREAS OF WORK MUST BE ACCESSIBLE UNTIL INSPECTION BY THE APPLICABLE CODE AUTHORITIES.

CORRECT UNACCEPTABLE FIRESTOPS AND PROVIDE ADDITIONAL INSPECTION TO VERIFY COMPLIANCE WITH THIS SPECIFICATION AT NO ADDITIONAL COST.

CALCULATE THE MAXIMUM CABLE FILL RATIO FOR EACH FIRESTOPPING SYSTEM AND CABLE TYPE. DO NOT EXCEED THE MAXIMUM FILL RATIO.

PREPARE AND INSTALL FIRESTOPPING SYSTEMS IN ACCORDANCE WITH MANUFACTURER’S PRINTED INSTRUCTIONS AND RECOMMENDATIONS.

WARRANTY

A. COMPLY WITH GENERAL CONDITIONS, AND INCLUDE BUT NOT BE LIMITED TO:

1. REPAIRS AND REPLACEMENT OF PENETRATION SEALS WHICH FAIL IN JOINT ADHESION, COHESION, ABRASION, RESISTANCE, WEATHER RESISTANCE, EXTRUSION RESISTANCE, MIGRATION RESISTANCE, STAIN RESISTANCE, OR GENERAL DURABILITY, OR APPEAR TO DETERIORATE IN ANY OTHER MANNER NOT CLEARLY SPECIFIED IN SUBMITTED MANUFACTURER’S DATA AS AN INHERENT QUALITY OF THE MATERIAL FOR EXPOSURE INDICATED.

CLEANING

REMOVE SPILLED AND EXCESS MATERIALS ADJACENT TO FIRESTOPPING WITHOUT DAMAGING ADJACENT SURFACES.

LEAVE FINISHED WORK IN NEAT, CLEAN CONDITION WITH NO EVIDENCE OF SPILLOVERS OR DAMAGE TO ADJACENT SURFACES.

COORDINATION

STORAGE AND HANDLING: AVOID BREAKAGE, DENTING AND SCORING FINISHES. DAMAGED PRODUCTS WILL NOT BE INSTALLED. STORE MATERIALS IN ORIGINAL CARTONS AND IN A CLEAN DRY SPACE; PROTECT FROM WEATHER AND CONSTRUCTION TRAFFIC. WET MATERIALS WILL BE UNPACKED AND DRIED BEFORE STORAGE.

PRODUCTS

APPROVED PRODUCTS

DRY LOCATION DEVICE BOXES: MANUFACTURER SHALL BE:

STEEL CITY, RAND-L, HUBBELL, OR RACO
EQUIVALENT PRODUCTS BY OTHER MANUFACTURERS MAY BE USED WHERE APPROVED IN WRITING BY OWNER'S REPRESENTATIVE.

MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

WET LOCATION BOXES: MANUFACTURER SHALL BE:

STEEL CITY, RAND-L, HUBBELL, OR RACO
EQUIVALENT PRODUCTS BY OTHER MANUFACTURERS MAY BE USED WHERE APPROVED IN WRITING BY OWNER'S REPRESENTATIVE.

MATERIAL SHALL BE MANUFACTURED IN THE UNITED STATES OF AMERICA.

EXECUTION

INSTALL CONDUITS USING TECHNIQUES, PRACTICES, AND METHODS THAT ARE CONSISTENT WITH CATEGORY 6 OR HIGHER REQUIREMENTS AND THAT SUPPORTS CATEGORY 6 OR HIGHER PERFORMANCE OF COMPLETED AND LINKED SIGNAL PATHS, END TO END.

FOLLOW MANUFACTURER’S RECOMMENDATIONS FOR ALLOWABLE FILL CAPACITY FOR EACH SIZE NON-CONTINUOUS CABLE SUPPORT.

REVISE LOCATIONS AND ELEVATIONS FROM THOSE INDICATED AS REQUIRED TO SUIT FIELD CONDITIONS AND AS APPROVED BY THE ARCHITECT.

PRODUCTS

MANUFACTURERS

SUBJECT TO COMPLIANCE WITH REQUIREMENTS, PROVIDE PRODUCTS BY THE FOLLOWING:

MATERIALS AND FINISHES:

CABLE TRAY MATERIALS:

CARBON STEEL WIRE, A 510, GRADE 1008. WIRE WELDED, BENT, AND SURFACE TREATED AFTER MANUFACTURE.

CABLE TRAY FINISHES:

FINISH FOR CARBON STEEL WIRE AFTER WELDING AND BENDING OF MESH.

ELECTRODEPOSITED ZINC PLATING: B 633, TYPE III, SC-1.

POWDER-COATED TRAYS – UL CLASSIFIED BLACK POWDER-COATED SURFACE TREATMENT OVER ELECTRODEPOSITED ZINC PLATING (OR PLAIN STEEL) USING ASA 61 BLACK POLYESTER COATING.

CABLE TRAY WILL CONSIST OF CONTINUOUS, RIGID, WELDED STEEL WIRE MESH CABLE MANAGEMENT SYSTEM, TO ALLOW CONTINUOUS VENTILATION OF CABLES AND MAXIMUM DISSIPATION OF HEAT, WITH UL CLASSIFIED SPLICES WHERE TRAY(INCLUDING UL CLASSIFIED PAINTED TRAY) ACTS AS EQUIPMENT GROUNDING CONDUCTOR (EGC). WIRE MESH CABLE TRAY WILL HAVE CONTINUOUS SAFE-T-EDGE T-WELDED TOP SIDE WIRE TO PROTECT CABLE INSULATION AND INSTALLERS.

PROVIDE SPLICES, SUPPORTS, AND OTHER FITTINGS NECESSARY FOR A COMPLETE, CONTINUOUSLY GROUNDED SYSTEM.

MESH: 2 X 4 INCHES (50 X 100 MM).

STRAIGHT SECTION LENGTHS: 118 INCHES (3,000 MM).

WIRE DIAMETER: PATENTED DESIGN INCLUDES VARYING WIRE SIZES TO MEET APPLICATION LOAD REQUIREMENTS; TO OPTIMIZE TRAY STRENGTH; AND TO ALLOW TRAY TO REMAIN LIGHTWEIGHT.

SAFE-T-EDGE: PATENTED SAFE-T-EDGE TECHNOLOGY ON SIDE WIRE TO PROTECT CABLE INSULATION AND INSTALLERS' HANDS.

FITTINGS: WIRE MESH CABLE TRAY FITTINGS ARE FIELD FABRICATED FROM STRAIGHT TRAY SECTIONS, IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND ITEM 2.3.

CF SERIES CABLE TRAY SIZE:

DEPTH: CABLE TRAY DEPTH WILL BE 4 INCHES

WIDTH: CABLE TRAY WIDTH WILL BE 6 ,12, 18, OR 24 INCHES AS SHOWN ON TELECOMMUNICATIONS DRAWINGS:

LENGTH: CABLE TRAY SECTION LENGTH WILL BE 118 INCHES (3000MM) UNLESS OTHERWISE SHOWN ON DRAWINGS.

FILL RATIO: CABLE TRAY MAY BE FILLED TO TOTAL FILL CAPACITY PER . MINIMUM 20% SPARE CAPACITY RECOMMENDED TO ACCOMMODATE FUTURE CABLING CHANGES OR ADDITIONS.

LOAD SPAN CRITERIA:

CABLE TRAY WILL BE CAPABLE OF CARRYING A UNIFORMLY DISTRIBUTED LOAD OF 50 POUNDS PER FOOT ON AN 8 FT SUPPORT SPAN, ACCORDING TO LOAD TESTS OF STANDARD SHOWN IN ITEM A ABOVE.

CABLE TRAY SUPPORTS & ACCESSORIES

FAS SYSTEM SUPPORT METHODS TO MOUNT FROM CEILING AND WALL STRUCTURES WITH 1/4", 3/8" OR 1/2" THREADED ROD, IF APPLICABLE

SPLICES, INCLUDING THOSE APPROVED FOR ELECTRICAL CONTINUITY (BONDING), AS RECOMMENDED BY CABLE TRAY MANUFACTURER. SELECT ONE OF THE FOLLOWING SPLICING METHODS, IF APPLICABLE:

UL CLASSIFIED EDRN FAST SPLICE: NO HARDWARE REQUIRED.

UL CLASSIFIED SPLICE WASHER KIT: SWAGED SET FOR SPLICING, TURNS, BENDS, TEES

UL CLASSIFIED ED UNIVERSAL SPLICE BAR: CUT & BEND TO FIT ANY CONFIGURATION.

PRECLICK SPLICE: BOLTED CONNECTION OPTIONAL

UL CLASSIFIED SPLICE PLATE: BOLTED CONNECTION

UL CLASSIFIED CE 25 & CE 30 SQUARE SPLICE WASHERS: USE WITH EZ BN ¼" NUT & BOLT

UL CLASSIFIED CE 40 SQUARE SPLICE WASHER: USE WITH EZ BN ¼" TO SPLICE TRAYS ON BENDS, ADJUSTABLE TEES

FASLOCK SPLICE: FOR SWEEPS AND BENDS WITH TRAY 12" (300MM) AND WIDER.

UL CLASSIFIED EZ T 90 KIT: FOR TEES AND 90S

UL CLASSIFIED RADT90 KIT: FOR 5-1/2" RADIUS TEES AND 90S

ACCESSORIES: AS REQUIRED TO PROTECT, SUPPORT, AND INSTALL A CABLE TRAY SYSTEM. SELECT FROM THE FOLLOWING ACCESSORIES, IF APPLICABLE:

EQUIPMENT GROUNDING CONDUCTOR FUNCTION & GROUNDING

UL CLASSIFIED CABLE TRAYS (INCLUDING PAINTED TRAY) MAY ACT AS EQUIPMENT GROUNDING CONDUCTORS.

USE UL CLASSIFIED SPLICING METHODS TO ENSURE CABLE TRAY IS ELECTRICALLY CONTINUOUS AND BONDED AS RECOMMENDED.

GROUND CABLE TRAYS AT END OF CONTINUOUS RUN.

TEST CABLE TRAY SYSTEM PER NFPA70B, CHAPTER 18 TO VERIFY GROUNDING LESS THAN 1 OHM.

GROUND CABLE TRAYS AGAINST FAULT CURRENT, NOISE, LIGHTNING, AND ELECTROMAGNETIC INTERFERENCE BY MOUNTING GROUNDING WIRE TO EACH 10' CABLE TRAY SECTION WITH GROUNDING CLAMP.

EXECUTION

EXAMINATION:

INSTALL CABLE TRAY LEVEL AND PLUMB ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS, COORDINATION DRAWINGS, ORIGINAL DESIGN, AND REFERENCED STANDARDS.

CUTTING: FIELD-FABRICATED CHANGES IN DIRECTION & ELEVATION BY CUTTING & BENDING CABLE TRAY.

CUT CABLE TRAY WIRES IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

CABLE TRAY WIRES MUST BE CUT WITH SIDE-ACTION BOLT CUTTERS WITH OFFSET HEAD TO ENSURE INTEGRITY OF PROTECTIVE GALVANIC LAYER.

REMOVE BURRS AND SHARP EDGES FROM CABLE TRAYS.

CONDUIT TYPES

EXAMPLES OF CONDUIT TYPES INCLUDE:

— DB-120 – FOR DIRECT BURIAL OR ENCASEMENT IN CONCRETE;

— RIGID NONMETALLIC CONDUIT SCHEDULE 40 – FOR DIRECT BURIAL OR ENCASEMENT IN CONCRETE;

— RIGID NONMETALLIC CONDUIT SCHEDULE 80 – FOR DIRECT BURIAL OR ENCASEMENT IN CONCRETE;

— RIGID METALLIC CONDUIT – FOR DIRECT BURIAL OR ENCASEMENT IN CONCRETE;

— INTERMEDIATE METALLIC CONDUIT – FOR DIRECT BURIAL OR ENCASEMENT IN CONCRETE;

THE LENGTH OF CONDUIT BETWEEN PULLING POINTS SHALL NOT EXCEED 600 FT (183M).

MANUFACTURED BENDS SHOULD BE USED WHENEVER POSSIBLE. NO SECTION OF CONDUIT SHALL CONTAIN MORE THAT TWO 90-DEGREE BENDS, OR EQUIVALENT BETWEEN PULL POINTS.

CONDUITS SHOULD BE INSTALLED SUCH THAT A SLOPE EXISTS TO ALLOW DRAINAGE AND PREVENT THE ACCUMULATION OF WATER.

WHEN CONDUITS CONNECT MAINTENANCE HOLES, A SLOPE OF .125 IN PER FOOT (10 MM PER METER) SHOULD EXITS FROM THE MIDDLE OF THE SPAN TO EACH MAINTENANCE HOLE.

CONDUITS MUST BE BURIED AT A MINIMUM DEPTH OF 18 IN. (45.7 CM).

QUALITY ASSURANCE

ALL LABELS SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER. ALL METHODS OF LABELING THAT ARE NOT SPECIFICALLY DESCRIBED OR INDICATED IN THE CONTRACT DOCUMENTS SHALL BE SUBJECT TO THE CONTROL AND APPROVAL OF THE OWNER OR OWNER REPRESENTATIVE.

LABELS SHALL BE OF THE QUALITY AND MANUFACTURE INDICATED. THE LABELS AND LABELING EQUIPMENT SPECIFIED ARE BASED UPON THE ACCEPTABLE MANUFACTURERS LISTED. WHERE "APPROVED EQUAL" IS STATED, EQUIPMENT SHALL BE EQUIVALENT IN EVERY WAY TO THAT OF THE EQUIPMENT SPECIFIED AND SUBJECT TO APPROVAL.

PRODUCTS

LABELS

SHALL BE PREPRINTED OR COMPUTER PRINTED TYPE. HANDWRITTEN LABELS ARE NOT ACCEPTABLE.

WHERE INSERT TYPE LABELS ARE USED PROVIDE CLEAR PLASTIC COVER OVER LABEL.

OUTSIDE PLANT LABELS SHALL BE TOTALLY WATERPROOF EVEN WHEN SUBMERGED.

EXECUTION

IDENTIFICATION & LABELING

ALL LABELS SHALL BE PRINTED OR GENERATED BY A MECHANICAL DEVICE.

TELECOMMUNICATION IDENTIFIERS

OUTSIDE PLANT CABLING SHALL BE CLEARLY MARKED USING PERMANENT MEANS. OUTSIDE PLANT SHALL USE THE FOLLOWING SYSTEM OF NUMBERING AND LABELING:

FIBER OPTIC:

IDENTIFY: FAR-END BUILDING NAME, BUILDING NUMBER, FIBER-TYPE AND STRAND-COUNT

LABEL AT ENTRANCE AND EXIT POINTS OF TUNNEL SYSTEM AND AT CONDUIT ENTRY POINTS BETWEEN 12 INCHES AND 36 INCHES FROM THE CONDUIT OR AT CLOSET POINT THAT IS CLEARLY VISIBLE AND LONG CABLE LENGTH IN TUNNEL AT 200-FOOT INTERVALS.

LABEL AT TERMINATION PANELS AT BOTH ENDS.

COPPER:

IDENTIFY: FAR-END BUILDING NAME, BUILDING NUMBER AND STRAND-COUNT

LABEL AT ENTRANCE AND EXIT POINTS OF TUNNEL SYSTEM AND AT CONDUIT ENTRY POINTS BETWEEN 12 INCHES AND 36 INCHES FROM THE CONDUIT OR AT CLOSET POINT THAT IS CLEARLY VISIBLE AND LONG CABLE LENGTH IN TUNNEL AT 200-FOOT INTERVALS.

RISER CABLING SHALL BE CLEARLY MARKED USING PERMANENT MEANS. RISER CABLING SHALL USE THE FOLLOWING SYSTEM OF NUMBERING AND LABELING:

FIBER OPTIC:

IDENTIFY: FAR-END EF / ER / TR, FIBER-TYPE AND STRAND-COUNT.

WHEN SMALL FACILITIES ARE FED FROM A PRIMARY LOCATION AND TREATED AS AN ER, RISER SHALL BE LABELED SIMILAR TO OUTSIDE PLANT FIBER OPTIC.

COPPER:

IDENTIFY: FAR-END EF / ER / TR AND PAIR-COUNT

TERMINATION POINTS SHALL BE LABELED AS TO ACTUAL PAIR AT EVERY FIFTH (5TH) PAIR-POINT.

LABELING PROCEDURES

TO BE CONSISTENT WITH /TIA/EIA STANDARDS AND INDUSTRY PRACTICES, IT IS IMPORTANT THAT BOTH LABELING AND COLOR CODING BE APPLIED TO ALL TELECOMMUNICATIONS INFRASTRUCTURE COMPONENTS. LABELING WITH THE UNIQUE IDENTIFIER WILL IDENTIFY A PARTICULAR COMPONENT. PROPER COLOR CODING WILL QUICKLY IDENTIFY HOW THAT COMPONENT IS USED IN THE OVERALL TELECOMMUNICATIONS INFRASTRUCTURE OF THE FACILITY.

VISIBILITY AND DURABILITY:

LABELS ARE GENERALLY OF EITHER THE ADHESIVE OR INSERT TYPE. ALL LABELS MUST BE LEGIBLE, RESISTANT TO DEFACEMENT, AND MAINTAIN ADHESION TO THE APPLICATION SURFACE.

OUTSIDE PLANT LABELS SHALL BE TOTALLY WATERPROOF, EVEN WHEN SUBMERGED.

LABELS APPLIED DIRECTLY TO A CABLE SHALL HAVE A CLEAR VINYL WRAPPING APPLIED OVER THE LABEL AND AROUND THE CABLE TO PERMANENTLY AFFIX THE LABEL.

OTHER TYPES OF LABELS, SUCH AS TIE-ON LABELS, MAY BE USED. HOWEVER, THE LABEL MUST BE APPROPRIATE FOR THE ENVIRONMENT IN WHICH IT IS USED, AND MUST BE USED IN THE MANNER INTENDED BY THE MANUFACTURER.

MECHANICAL GENERATION

1. ALL LABELS SHALL BE PRINTED OR GENERATED BY A MECHANICAL DEVICE.

2. HAND WRITTEN LABELS ARE NOT ACCEPTABLE.

END OF SECTION

3.X PATHWAYS FOR COMMUNICATIONS SYSTEMS

GENERAL

SCOPE OF WORK

INSTALL EMPTY RACEWAY SYSTEM, INCLUDING UNDERFLOOR AND OVERHEAD DISTRIBUTION SYSTEM, FISH WIRE, TERMINAL CABINETS, OUTLET BOXES, FLOOR BOXES, PULL BOXES, COVER PLATES, CONDUIT, SLEEVES AND CAPS, CABLE TROUGHS, SERVICE POLES, MISCELLANEOUS AND POSITIONING MATERIAL TO CONSTITUTE COMPLETE SYSTEM, AS INDICATED FOR DISTRIBUTION OF TELECOMMUNICATIONS WIRING WHICH INCLUDES CABLES FOR DATA, VOICE, VIDEO, AUDIO, SECURITY, AND FUTURE SIGNAL REQUIREMENTS.

THE LOCATION AT WHICH ALL NEW TELECOMMUNICATIONS WIRING WILL TERMINATE IS CALLED A TELECOM OUTLET (TO). THERE ARE SEVERAL STYLES OF OUTLETS:

NEW CONSTRUCTION

EXISTING CONSTRUCTION TYPICAL

EXISTING CONSTRUCTION VARIATIONS

TELEPHONE (VOICE) ONLY.

DATA ONLY

FURNISH AND INSTALL SPLIT CHANNEL RACEWAY AND OUTLET BOXES AS SPECIFIED IN THE DRAWINGS AND AS SPECIFIED HEREIN.

FURNISH AND INSTALL CONDUIT STUBS IN WALLS AND FLOORS FOR CABLE ROUTES.

QUALITY ASSURANCE:

ALL CABLE AND EQUIPMENT SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER. ALL METHODS OF CONSTRUCTION THAT ARE NOT SPECIFICALLY DESCRIBED OR INDICATED IN THE CONTRACT DOCUMENTS SHALL BE SUBJECT TO THE CONTROL AND APPROVAL OF THE OWNER OR OWNER REPRESENTATIVE. EQUIPMENT AND MATERIALS SHALL BE OF THE QUALITY AND MANUFACTURE INDICATED. THE EQUIPMENT SPECIFIED IS BASED UPON THE ACCEPTABLE MANUFACTURERS LISTED. WHERE "APPROVED EQUAL" IS STATED, EQUIPMENT SHALL BE EQUIVALENT IN EVERY WAY TO THAT OF THE EQUIPMENT SPECIFIED AND SUBJECT TO APPROVAL.

ASSURE THAT THE "AS INSTALLED" SYSTEM IS CORRECTLY AND COMPLETELY DOCUMENTED INCLUDING ENGINEERING DRAWINGS, MANUALS, AND OPERATIONAL PROCEDURES IN SUCH A MANNER AS TO SUPPORT MAINTENANCE AND FUTURE EXPANSION OF THE SYSTEM.

SUBMITTALS

PRODUCT DATA: FOR FEATURES, RATINGS, AND PERFORMANCE OF EACH COMPONENT SPECIFIED.

3.X HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

GENERAL

WORK INCLUDES

THE WORK COVERED UNDER THIS SECTION CONSISTS OF THE FURNISHING OF ALL NECESSARY LABOR, SUPERVISION, MATERIALS, EQUIPMENT, AND SERVICES TO COMPLETELY EXECUTE THE SYSTEM OF NON-CONTINUOUS CABLE SUPPORTS AS DESCRIBED IN THIS SPECIFICATION.

SCOPE OF WORK

THIS SECTION INCLUDES THE MINIMUM REQUIREMENTS FOR THE SUPPORT STRUCTURES FOR THE COMMUNICATIONS SYSTEMS FOR THE PROJECT AS OUTLINED IN THE BID DOCUMENT.

A. NON-CONTINUOUS CABLE SUPPORTS (2.3A)

B. ADJUSTABLE NON-CONTINUOUS CABLE SUPPORT SLING (2.3B)

C. MULTI-TIERED NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES (2.3C)

D. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM TEE BAR (2.3D)

E. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM DROP WIRE/CEILING (2.3E)

F. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM BEAM, FLANGE (2.3F)

G. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM C & Z PURLIN (2.3G)

H. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM WALL, CONCRETE, OR JOIST (2.3H)

I. NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES FROM THREADED ROD (2.3I)

J. RAISED FLOOR NON-CONTINUOUS CABLE SUPPORT ASSEMBLIES (2.3J)

K. CANTILEVER-MOUNTED OPTION FOR NON-CONTINUOUS CABLE SUPPORTS (2.3K)

3.X FIRESTOPPING FOR TELECOMMUNICATIONS SYSTEMS

EXECUTION

GENERAL REQUIREMENTS

THE INTENTION OF THE TELECOMMUNICATIONS CONDUITS IS TO PROVIDE A ROUTE BETWEEN ER AND TR ROOMS, ROUTES FROM THE TRS THROUGHOUT BUILDING FLOORS TO HALLWAYS, AND ROUTES FROM HALLWAY DISTRIBUTION SYSTEMS INTO ROOMS TO INDIVIDUAL TOS FOR TELECOMMUNICATIONS CABLING.

GENERAL

SCOPE

THIS SECTION DESCRIBES THE REQUIREMENTS FOR FURNISHING AND INSTALLING FIRESTOPPING FOR FIRE-RATED CONSTRUCTION. THIS INCLUDES ALL OPENINGS IN FIRE-RATED FLOORS, WALLS AND OTHER RATED ELEMENTS OF CONSTRUCTION, BOTH BLANK (EMPTY) AND THOSE ACCOMMODATING ITEMS SUCH AS CABLES, CONDUITS, PIPES, DUCTS, ETC.

FIRE BLOCKING FOR CONCRETE FLOOR OR WALL SLEEVED CABLES.

FIRE BLOCKING FOR GYPSUM WALL SLEEVED CABLES.

FIRE BLOCKING FOR CONCRETE BLOCK WALL SLEEVED CABLES.

RELATED DOCUMENTS:

DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 7 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

SUBMITTALS

3.X CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

GENERAL

OUTLETS CAT5E AND CAT6

EACH DATA OUTLET IN A WALL OR FLOOR SHALL BE SERVED BY TWO (2) 1 IN. CONDUITS AND A DOUBLE-GANG DEEP DEVICE BOX WITH A SINGLE-GANG MUD RING.

WALL MOUNTED TELEPHONES SHALL BE SERVED BY ONE 0.75 IN. CONDUIT AND A SINGLE-GANG DEEP DEVICE BOX WITH A SINGLE-GANG MUD RING. THE OUTLET BOX SHALL BE MOUNTED AT A CENTER HEIGHT OF 48 IN. ABOVE THE FINISHED FLOOR, UNLESS OTHERWISE SPECIFIED ON THE DRAWING, AND SHALL HAVE A CLEARANCE OF 12 IN. OF WALL SURFACE ON ALL SIDES.

ALL OUTLET CONDUITS SHALL BE STUBBED INTO ACCESSIBLE CEILING SPACE.

ALL OUTLET CONDUITS SHALL HAVE BURRS AND ANY OTHER ABRASIVE ELEMENTS REMOVED AND AN INSULATING BUSHING SHALL BE INSTALLED ON BOTH ENDS.

NO SECTION OF CONDUIT SHALL BE LONGER THAN 30 M (100 FT.) BETWEEN PULL POINTS.

NO MORE THAN 180 DEGREES OF CONDUIT BENDS SHALL BE PERMITTED BETWEEN PULL POINTS.

THE MINIMUM INSIDE RADIUS FOR ANY BEND OF AN OUTLET CONDUIT SHALL BE SIX TIMES THE INSIDE DIAMETER OF THAT CONDUIT.

OUTLETS CAT6A

EACH DATA OUTLET IN A WALL OR FLOOR SHALL BE SERVED BY TWO (2) 1.25 IN. CONDUITS AND A 5-SQUARE DOUBLE-GANG DEEP DEVICE BOX WITH A SINGLE-GANG MUD RING.

APPROVED MANUFACTURES: STEEL CITY, RAND-L, OR APPROVED EQUAL

ALL OUTLET CONDUITS SHALL BE STUBBED INTO ACCESSIBLE CEILING SPACE.

ALL OUTLET CONDUITS SHALL HAVE BURRS AND ANY OTHER ABRASIVE ELEMENTS REMOVED AND AN INSULATING BUSHING SHALL BE INSTALLED ON BOTH ENDS.

NO SECTION OF CONDUIT SHALL BE LONGER THAN 30 M (100 FT.) BETWEEN PULL POINTS.

NO MORE THAN 180 DEGREES OF CONDUIT BENDS SHALL BE PERMITTED BETWEEN PULL POINTS.

THE MINIMUM INSIDE RADIUS FOR ANY BEND OF AN OUTLET CONDUIT SHALL BE SIX TIMES THE INSIDE DIAMETER OF THAT CONDUIT.

CONDUITS

ELECTRIC METALLIC TUBING: COMPLY WITH UL 797. TUBING SHALL HAVE HOT DIPPED GALVANIZED EXTERIOR, ENAMEL-COATED INTERIOR.

FLEXIBLE CONDUIT SHALL NOT BE USED IN LIEU OF CONDUIT BENDS AND OFFSETS.

PVC CONDUIT: COMPLY WITH UL 651, LISTED FOR USE WITH 90 DEGREES C CONDUCTORS OPERATING AT 90 DEGREES C.

STANDARDS COMPLIANCE

GENERAL STANDARDS: COMPLY WITH CURRENT REVISION OF TIA 569 AS AMENDED.

SUBMITTALS

PROVIDE PRODUCT DATA FOR THE FOLLOWING:

3.X CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

GENERAL

SCOPE

CONTINUOUS, RIGID, WELDED STEEL OR STAINLESS-STEEL WIRE MESH CABLE MANAGEMENT SYSTEM.

CABLE TRAY SYSTEMS ARE DEFINED TO INCLUDE, BUT ARE NOT LIMITED TO, STRAIGHT SECTIONS, SUPPORTS AND ACCESSORIES.

RELATED DOCUMENTS:

DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 1 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

QUALITY ASSURANCE

SOURCE LIMITATIONS: OBTAIN CABLE TRAY COMPONENTS THROUGH ONE SOURCE FROM A SINGLE MANUFACTURER.

COMPLY WITH CALIFORNIA ELECTRICAL CODE, ARTICLE 392: CABLE TRAYS; PROVIDE UL CLASSIFICATION AND LABELS.

COORDINATION

3.X UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS

3.X IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

GENERAL

WORK INCLUDES

WORK COVERED BY THIS SECTION SHALL CONSIST OF FURNISHING LABOR, EQUIPMENT AND MATERIALS NECESSARY FOR THE LABELING OF THE TELECOMMUNICATIONS INFRASTRUCTURE AS DESCRIBED ON THE DRAWINGS AND/OR REQUIRED BY THESE SPECIFICATIONS.

SCOPE OF WORK

THIS SECTION INCLUDES THE MINIMUM REQUIREMENTS FOR THE IDENTIFICATION AND LABELING OF THE COMMUNICATIONS SYSTEMS FOR THE PROJECT AS OUTLINED IN THE BID DOCUMENT.

SUMMARY

ADMINISTRATION OF THE TELECOMMUNICATIONS INFRASTRUCTURE INCLUDES DOCUMENTATION OF CABLES, TERMINATION HARDWARE, PATCHING AND CROSS-CONNECTION FACILITIES, CONDUITS, OTHER CABLE PATHWAYS, TELECOMMUNICATIONS ROOMS, AND OTHER TELECOMMUNICATIONS SPACES. ALL FACILITIES SHALL APPLY AND MAINTAIN A SYSTEM FOR DOCUMENTING AND ADMINISTERING THE TELECOMMUNICATIONS INFRASTRUCTURE.

INDUSTRY LABELING STANDARDS AND CONVENTIONS SHALL BE USED UNLESS OTHERWISE STATED IN THE BID DOCUMENTS OR BY THE OWNER'S REPRESENTATIVE.

TELECOMMUNICATIONS INFRASTRUCTURE RECORDS MUST BE MAINTAINED IN A COMPUTER SPREADSHEET, OR IN A COMPUTER DATABASE. PAPER RECORDS ARE ENCOURAGED, BUT ARE OPTIONAL. A CABLE RECORD IS PREPARED FOR EACH BACKBONE CABLE. THE RECORD WILL SHOW THE CABLE NAME, AND MUST DESCRIBE THE ORIGIN POINT AND DESTINATION POINT OF THE CABLE. THE CABLE RECORD WILL RECORD WHAT SERVICES AND/OR CONNECTIONS ARE ASSIGNED TO EACH CABLE PAIR OR STRAND. AN EQUIPMENT RECORD IS PREPARED FOR SERVICES DISTRIBUTED FROM A CERTAIN PIECE OF EQUIPMENT, SUCH AS A ROUTER, OR A SYSTEM SUCH AS THE TELEPHONE SYSTEM PBX.

SECTION 270529
HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other communications work.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 270533.13 - Conduit for Communications Systems: Additional support and attachment requirements for conduits.

D. Section 271000 - Structured Cabling.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition; 2022.

E. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

F. MFMA-4 - Metal Framing Standards Publication; 2004.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1) Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.

2) Coordinate work to provide additional framing and materials required for installation.

3) Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.

4) Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.

5) Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1) Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 033000.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable supports, channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Derating Calculations for Fiberglass Channel/Strut Framing Systems: Indicate load ratings adjusted for applicable service conditions.

E. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

F. Installer's qualification statement.

G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Maintain at project site one copy of each referenced document that prescribes execution requirements.

B. Installer Qualifications for Powder-Actuated Fasteners: Certified by fastener system manufacturer with current operator's license.

C. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1) Comply with the following. Where requirements differ, comply with most stringent.

a) TIA-569.
b) NFPA 70.
c) Requirements of authorities having jurisdiction.

2) Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of communications work.

3) Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.

4) Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.

5) Do not use products for applications other than as permitted by NFPA 70 and product listing.

6) Steel Components: Use corrosion-resistant materials suitable for environment where installed.

a) Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
b) Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit Supports: Straps and clamps suitable for conduit to be supported.

1) Conduit Straps: One-hole or two-hole type; steel or malleable iron.

2) Conduit Clamps: Bolted type unless otherwise indicated.

C. Cable Routing Assemblies:

D. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

E. Metal Channel/Strut Framing Systems:

1) Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.

2) Comply with MFMA-4.

F. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

G. Nonpenetrating Rooftop Supports for Low-Slope Roofs:

1) Manufacturers:

a) Eaton Corporation: www.eaton.com/#sle.

2) Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.

3) Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

4) Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.

5) Mounting Height: Provide minimum clearance of 6 inches (150 mm) under supported component to top of roofing.

H. Anchors and Fasteners:

1) Manufacturers - Mechanical Anchors:

a) Dewalt: anchors.dewalt.com/#sle.
b) Hilti, Inc: www.hilti.com/#sle.
c) ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
d) Substitutions: See Section 016000 - Product Requirements.

2) Manufacturers - Powder-Actuated Fastening Systems:

a) Hilti, Inc: www.hilti.com/#sle.
b) ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
c) Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
d) Substitutions: See Section 016000 - Product Requirements.

3) Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.

4) Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

5) Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

6) Hollow Stud Walls: Use toggle bolts.

7) Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.

a) Manufacturer: Same as manufacturer of metal channel/strut framing system.
b) Comply with MFMA-4.
c) Channel Material: Use galvanized steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Equipment Support and Attachment:

1) Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.

2) Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

3) Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4) Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

J. Secure fasteners in accordance with manufacturer's recommended torque settings.

K. Remove temporary supports.

END OF SECTION

SECTION 271100
COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Communications entrance protection.

B. Communications cabinets, racks, frames, and enclosures.

C. Communications termination blocks and patch panels.

D. Communications cable management.

E. Communications rack-mounted power protection and distribution.

F. Communications uninterruptible power supply (UPS).

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260553 - Identification for Electrical Systems.

C. Section 262733 - Power Distribution Units: Floor-standing PDUs.

D. Section 270529 - Hangers and Supports for Communications Systems.

E. Section 270536 - Cable Trays for Communications Systems.

F. Section 271000 - Structured Cabling.

1.3 ABBREVIATIONS AND ACRONYMS

A. PDU: Power distribution unit.

B. RCDD: Registered communications distribution designer.

C. UPS: Uninterruptible power supply.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

C. Shop Drawings: Include plan views indicating locations of equipment and proposed cable routing. Include elevations and details of proposed equipment arrangements, prepared and approved by BICSI RCDD.

D. Design Data:

1) Communications UPS standby battery calculations.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

F. Field quality control submittals.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Operation and Maintenance Data: Include detailed information on system operation, equipment setup, replacement parts, and recommended maintenance procedures and intervals.

J. Specimen warranty.

K. Executed warranty.

L. Field Test Reports.

M. Project Record Documents: Prepared and approved by BICSI RCDD.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 3 years of documented experience.

B. Installer Qualifications: Company having minimum 3 years of experience in installation and testing of type of system specified.

1) Employing BICSI RCDD.

2) Supervisors and installers factory certified by manufacturers of products to be installed.

3) Employing BICSI Registered Cabling Installation Technicians (RCIT) for supervision of work.

C. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL), and acceptable to authorities having jurisdiction.

D. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.7 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.8 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer warranty for defects in material and workmanship for duration below. Complete forms in Owner's name and register with manufacturer.

1) Communications UPS with VRLA Batteries: 3 years.

2) Communications UPS with Lithium-ion Batteries: 5 years.

PART 2 PRODUCTS

2.1 COMMUNICATIONS ENTRANCE PROTECTION

A. Comply with:

1) BICSI TDMM.

2) NFPA 70.

3) TIA-607.

B. Building Entrance Termination:

1) Provide for each circuit entrance from serving communications distribution.

2) Listed and labeled as compatible with communications cable used.

3) Include cable termination and grounding points.

4) Include integral surge protection.

2.2 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

A. Manufacturers:

1) AtlasIED: www.atlasied.com/#sle.

2) CommScope: www.commscope.com/#sle.

3) Chatsworth: www.Chatsworth.com/.

4) Substitutions: See Section 016000 - Product Requirements.

B. General Requirements:

1) Component Racks: EIA/ECA-310 standard 19 inches (482.6 mm) wide, unless otherwise indicated.

2) Listed as complying with UL 2416.

3) Cabinets: Steel construction with corrosion resistant finish.

4) Provide racks and shelves with static load rating suitable for supported loads.

5) Locks: Keyed alike.

C. Wall-Mounted Racks: Steel construction, hinged to allow access to back of installed components.

1) Minimum Static Load Rating: 300 lb (_____ kg).

D. Floor-Mounted Racks: Aluminum or steel construction with corrosion resistant finish; vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.

1) Minimum Static Load Rating: 500 lb (_____ kg).

E. Freestanding Cabinets: Front and rear doors with locks; removable side panels with locks; vented top and rear door; adjustable leveling feet; cable access in roof and base; grounding bar.

1) Minimum Static Load Rating: 500 lb (_____ kg).

2) Top-mounted fan, capacity _____.

F. Wall-Mounted Cabinets: Front doors with locks, louvered side panels, top and bottom cable access, and ground lug.

1) Cover inside of cabinet back with plywood backboard.

2) Minimum Static Load Rating: 300 lb (_____ kg).

3) Provide duplex receptacle, NEMA 5-20R inside cabinet.

G. Accessories:

1) 1U blanking panels, for each enclosure.

2.3 COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

A. Copper Cross-Connection Equipment:

1) Manufacturers:

a) Belden: www.belden.com/#sle.
b) CommScope: www.commscope.com/#sle.
c) Substitutions: See Section 016000 - Product Requirements.

2) Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19-inch (482.6 mm) wide equipment racks; 0.09-inch (2.2 mm) thick aluminum.

a) Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
b) Comply with TIA-568.2.
c) Include provisions for both T568A and T568B wiring configurations.
d) Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
e) Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
f) Provide incoming cable strain relief and routing guides on back of panel.

3) Products:

a) Belden; KeyConnect Patch Panels: www.belden.com/#sle.

B. Fiber Optic Cross-Connection Equipment:

1) Manufacturers:

a) Belden: www.belden.com/#sle.
b) CommScope: www.commscope.com/#sle.
c) Leviton: https://leviton.com/

2) Patch Panels for Fiber Optic Cabling: Sized to fit EIA/ECA-310 standard 19-inch (482.6 mm) wide equipment racks; 0.09-inch (2.2 mm) thick aluminum.

a) Comply with TIA-568.3; match cable.
b) Adapters:
Maximum of 24 duplex adaptors per standard panel width.
c) Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
d) Provide incoming cable strain relief and routing guides on back of panel.
e) Provide rear cable management tray at least 8-inches (203 mm) deep with removable cover.
f) Provide dust covers for unused adapters.

2.4 COMMUNICATIONS CABLE MANAGEMENT

A. Manufacturers:

1) CommScope: www.commscope.com/#sle.

B. Comply with BICSI TDMM for cable organization, minimizing strain relief, and cable bending limitations.

C. Comply with TIA-607 and NFPA 70 for bonding of metal parts with dedicated wiring or by using listed connections.

D. Cable Runway/Ladder Rack:

1) Provide complete cable runway system consisting of required components, fittings, supports, and accessories.

2) Material: Steel.

3) Products:

a) Belden; Belden Cable Runway: www.belden.com/#sle.
b) Substitutions: See Section 016000 - Product Requirements.

E. Horizontal/Vertical Cable Managers: Compatible with equipment racks.

1) Products:

a) Belden; Belden BHH/BHV Series Horizontal/Vertical Managers: www.belden.com/#sle.
b) .

F. Noncontinuous Cable Supports and Cable Routing Assemblies: See Section 270529.

G. Hook-and-Loop Cable Ties: See Section 271000.

2.5 COMMUNICATIONS RACK-MOUNTED POWER PROTECTION AND DISTRIBUTION

A. Manufacturers:

1) Eaton Corporation: www.eaton.com/#sle.

2) Schneider Electric; APC: www.se.com/#sle.

B. Rack Mounted Power Protection:

1) Provide line- and low-voltage branch power protection.

2) Comply with "SURGE PROTECTION" in communications entrance protection article above.

C. Rack Power Strips:

1) Description: UL 1363 listed and labeled, industrial grade power strip.

2) Provide AC rack-mounted power taps for equipment loads.

a) Maximum Dimensions: As indicated on drawings and coordinated with communications cabinet, rack, frame, or enclosure.
b) Provide at locations indicated on drawings.
c) Provide one per communications cabinet, rack, frame, or enclosure.

3) Mounting Orientation: Vertical.

4) Ratings: 120 V, 20 A.

5) Provide integral surge protection.

6) Number and Type of Load Receptacles: 12.

7) Cord Length: 1 M.

8) Input Plug and Receptacle Type: _____.

D. Rack-Mounted Power Distribution Units (PDUs):

1) Description: Listed, modular, segmented power distribution with common input power connections, for real-time branch monitoring of electrical attributes, branch level monitoring, for rack-mounted cord-and-plug equipment fed by NEMA and IEC receptacles.

2) Vertical Rack-Mounted PDU:

a) Height: 0U rack units.
b) Load Capacity: 4,992 VA.
c) Branch Circuit Overcurrent Protection: 30 A.
d) Maximum Input Current: 24 A.
e) Factory Connected Cable Length: 10 ft (3 m).
f) Input Voltage: 120V .

3) Provide switched AC rack-mounted PDUs for sensitive electronic equipment loads.

4) Display and Controls: Embedded microcontroller for monitoring and management via integral interface.

5) Support user-customizable power control and active monitoring.

6) Locally and remotely configurable for user-selected power sequence, including delays and user-defined alarms.

7) Characteristics:

a) Provide mounting configuration compatible with enclosure, rack, frame, or enclosure.
b) Maximum Continuous Output Current, per Connection:
NEMA 5-15 Outlets: 15 A.
IEC C13 Outlets: 15 A.
IEC C19 Outlets: 20 A.
c) Internal Overload Protection: Protect branch segments of rack-mounted PDUs containing multiple outlet types from overload with integral molded-case circuit breakers.
d) Remote Functionality:
Outlet Management: Switched.
Provide emergency power off compatibility.

8) Products:

a) Schneider Electric; APC; NetShelter Basic Rack PDUs: www.se.com/#sle.
b) Schneider Electric; APC; NetShelter AP7800 Series Metered Rack PDUs: www.se.com/#sle.
c) Schneider Electric; APC; NetShelter AP8800 Series Metered Rack PDUs: www.se.com/#sle.
d) Schneider Electric; APC; NetShelter AP8400 Series Metered-By-Outlet Rack PDUs: www.se.com/#sle.
e) Schneider Electric; APC; NetShelter AP7900 Series Switched Rack PDUs: www.se.com/#sle.
f) Schneider Electric; APC; NetShelter AP8900 Series Switched Rack PDUs: www.se.com/#sle.
g) Substitutions: See Section 016000 - Product Requirements.

2.6 COMMUNICATIONS UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. General Requirements:

1) Provide UPS-backed AC power to protect electronic equipment.

2) Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15.

3) Listed and labeled as complying with UL 1778.

4) DC-Link Battery Energy Source: Lithium-Ion.

B. Design:

1) Rectifier/Charger Capacity: Sufficient to supply full load to inverter while recharging fully-discharged battery to 95 percent of full capacity in four hours or less; and within input current limits.

2) Provide means for online testing of UPS, including test points to allow adjusting and servicing. Provide means for testing while in bypass.

3) Mean Time Between Failures: 60,000 hours, minimum.

4) Cooling: Natural convection.

5) Operate battery floating, isolated from UPS AC input and AC output. Battery may be resistance grounded through 5,000 to 10,000 ohms for purpose of ground fault sensing.

6) Do not use continuous moving parts or electron tubes. Accomplish power switching using semiconductor devices.

7) Construct equipment so that each power component can be replaced without soldering iron or special tools.

8) Use front-panel removable plug-in control modules.

C. System Ratings and Operating Characteristics:

1) Continuous Rating: As indicated on drawings, over entire battery voltage range at specified power factor. Maintain output voltage within specified limits at any load from no load to full load.

2) System Input:

a) Voltage:
Rating: 120 V, 1-phase.
Operating Range: Plus/minus 10 percent.
b) Current:
Limit: Adjustable to maximum of 125 percent of that required to operate at full load with battery bank on float charge.
Walk-in: 25 to 100 percent in fifteen seconds.
c) Frequency Operating Range: 60 Hz, plus/minus 3 Hz.
d) Power Factor: 74 to 100 percent, lagging, over full range of loads and input voltages.
e) Harmonic Distortion of Input Current Wave Form: 5 percent maximum at full load.

3) System Output:

a) Voltage:
Regulation:
(a) Plus/minus ____ percent for balanced load, full range of DC input and no load to full load variations.
(b) Plus/minus ____ percent for 50 percent unbalanced load, full range of DC input and no load to full load variations.
(c) Plus/minus ____ percent during maximum overload of the system.
Unbalance: 3 percent maximum line-line with 100 percent load unbalance.
Adjustment: Plus/minus _____ percent.
Transient Response: For application of 0 to 50 percent, 50 to 100 percent, 100 to 50 percent, and 50 to 0 percent step loads, and transfer to and from bypass line.
(a) Plus 8, minus 10 percent for maximum of 8.3 milliseconds.
(b) Plus/minus 5 percent for maximum of 25 milliseconds.
(c) Plus/minus 3 percent for maximum of 50 milliseconds.
(d) ____ percent for maximum of ____ milliseconds.
(e) Recovery to steady state within 100 milliseconds after any out-of-tolerance variation.
b) Frequency:
Free Running: 60 Hz Plus or minus 0.5 percent.
Adjustment: Plus/minus ____ Hz.
c) Phase Displacement:
120 plus/minus 1 degree for balanced loads.
120 plus/minus 4 degrees for 50 percent unbalanced loads.
120 plus/minus ____ degrees for _____.
d) Harmonic Distortion: Maximum 5 percent rms total harmonic distortion (THD) and maximum 3 percent any single harmonic, at rated frequency and voltage, from 10 percent load to full load and over battery voltage range, measured into linear load.
e) Overload Ratings:

4) Efficiency: ____ percent at full load, ____ percent at ____ percent load, minimum. Measure efficiency of unit including battery and isolation transformer losses.

D. Controls and Indicators:

1) Provide controls and indicators for monitoring UPS internal components and DC-Link.

2.7 ACCESSORIES

A. Backboards: Interior grade plywood without voids, 3/4-inch (19 mm) thick; listed and labeled as fire-retardant.

1) Locations: As indicated on drawings

2) Size: As indicated on drawings.

3) Do not paint over listing label.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements.

B. Verify ratings and configurations of system components.

C. Verify mounting surfaces are ready to receive system components.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to system where applicable.

E. Verify conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Comply with BICSI N1.

C. Wall-Mounted Racks and Cabinets:

1) Install to plywood backboards only, unless otherwise indicated.

2) Mount so height of topmost panel does not exceed 78-inches (1980 mm) above floor.

D. Floor-Mounted Racks and Cabinets: Permanently anchor to floor in accordance with manufacturer's recommendations.

E. Communication UPS:

1) Comply with NECA 411.

2) Measure input/output voltages and make adjustments.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Comply with inspection and testing requirements of specified installation standards.

C. Provide equipment, tools, and supplies required to accomplish inspection and testing.

D. Communications UPS: Test system in accordance with manufacturer's instructions.

E. Adjust settings as directed by Owner.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken

3.4 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish; including repair of scratched or marred surfaces.

3.5 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION

SECTION 275116
PUBLIC ADDRESS SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Amplifiers, controllers, and related equipment.

B. Input sources.

C. Speaker appliances.

D. Wire and cable.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems.

D. Section 270529 - Hangers and Supports for Communications Systems.

E. Section 270533.13 - Conduit for Communications Systems.

F. Section 270536 - Cable Trays for Communications Systems.

G. Section 271000 - Structured Cabling.

H. Section 275313 - Clock Systems.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

C. BICSI TDMM - Telecommunications Distribution Methods Manual, 15th Edition; 2024.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 90 - Standard for Commissioning Building Electrical Systems; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2024.

H. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

I. TIA-607 - Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2024e.

J. UL 1480 - Standard for Speakers for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

K. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1) Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

2) Coordinate arrangement of equipment with dimensions and clearance requirements.

3) Coordinate colors of public address systems with required identification.

4) Equipment:

a) Coordinate power branch circuit protection and identification.
b) Coordinate equipment cord-and-plug and receptacle configuration.
c) Coordinate equipment POE requirements.
d) Coordinate equipment monitoring requirements required for integration with building management system (BMS).

5) Framing and Supports:

a) Coordinate sizes and arrangement of supports and bases with equipment and components.
b) Coordinate work to provide additional framing and materials required for installation.
c) Coordinate work with placement of supports and anchors required for mounting.

6) Coordinate work to avoid placement of ductwork, piping, equipment, diffusers, fire suppression system components, and other obstructions within spaces dedicated for public address systems.

7) Coordinate with communications equipment racks for equipment placements, cable management, and associated interconnections.

8) Coordinate associated communications cabling required for complete system capable of functions indicated.

9) Verify exact conduit termination locations required including boxes, enclosures, and equipment.

B. Preinstallation Meeting:

1) Convene one week prior to commencing work of this section. Review proposed construction staging, sequence of installation, and protection requirements for system.

2) Review anticipated noise levels compared to design estimations. Identify locations over 95 dB and confirm system design and planned installation considers intelligibility of messages for listeners.

3) Review microphone muting requirements with Owner prior to programming operating procedures.

C. Sequencing:

1) Perform field measurements prior to installation.

2) Conduct meeting with facility representative to review installation locations and requirements for interconnecting with indicated Owner systems.

3) Verify naming convention for identification prior to creation of final drawings, reports, and labels.

4) Sequence work with affected installers to guard against damage.

5) Do not install devices or identification products until final surface finishes and painting are complete.

6) Do not locate ceiling speakers directly above devices with external microphones.

7) Do not point horns toward devices with external handsets used for paging.

8) Do not proceed with stages of work until above-ceiling inspections and corrections are complete.

9) Do not begin installation of communications cables until installation of conduit between termination points is complete.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:

1) Provide manufacturer's standard catalog pages and data sheets for each system component.

2) Include ratings, configurations, standard wiring diagrams, outline dimensions, finishes, weights, service condition requirements, and installed features.

C. Shop Drawings:

1) Indicate electrical characteristics and connection requirements.

2) Indicate layout of equipment mounted in racks and cabinets, component interconnecting wiring, and wiring diagrams of field wiring to speakers and remote input devices.

3) Include dimensioned plan views indicating locations of system components, required clearances, attachment locations and details, and proposed size, type, and routing of conduits and/or cables.

4) Include system interconnection schematic diagrams and proposed arrangement of loudspeaker control zones.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Delegated Design Documents:

1) Identify type, number, and placement of loudspeakers, seated or standing listeners, building features and final materials for acoustics, sound pressure levels (SPLs), reverberation, absorption, frequency response, signal-to-noise-ration (SNR), power requirements, speech-transmission-index (STI), direct versus reverberant sound, and special applications requiring intelligible audio.

2) Prepare and submit information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

F. Design Data:

1) Battery capacity and end-of-life runtime calculations.

2) Circuit and zone capacity calculations.

G. Test Reports: Sound level survey.

H. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

I. Field quality control submittals.

J. Manufacturer's qualification statement.

K. Supplier's qualification statement.

L. Installer's qualification statement.

M. Maintenance contract.

N. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1) Include contact information for entity that will be providing contract maintenance and trouble call-back service.

O. Specimen warranty.

P. Executed warranty.

Q. Project Record Documents: Indicate actual locations of speakers, control equipment, and outlets for input/output connectors. Include final equipment settings and installed wiring arrangements/routing.

1.6 QUALITY ASSURANCE

A. Comply with the following:

1) ADA Standards.

2) NFPA 70.

3) Federal Communications Commission (FCC) requirements.

4) Requirements of authorities having jurisdiction.

5) Applicable TIA/EIA standards.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 3 years years of documented experience.

C. Supplier Qualifications: Company specializing in supplying products specified in this section, with minimum 3 years years of documented experience; authorized by manufacturer.

D. Installer Qualifications: Company specializing in installing products specified in this section with minimum 3 years of documented experience.

1) Contract maintenance office located within 100 miles (___ km) of project site.

E. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL), and acceptable to authorities having jurisdiction.

F. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

B. Existing Conditions: Perform sound level survey.

1) Follow sound level survey procedures in FIELD QUALITY CONTROL in PART 3.

2) Submit detailed reports indicating sound level results by zone or area in accordance with system design.

1.9 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 20 manufacturer warranty. Complete forms in Owner's name and register with manufacturer.

C. Installer Warranty: Provide 2-year warranty commencing on mm-dd-yyyy. Complete forms in Owner's name and register with installer.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. AtlasIED: www.atlasied.com/#sle.

2.2 PUBLIC ADDRESS SYSTEM

A. Provide new public address system including required amplifiers, controllers, signal routing and processing equipment, input sources, speaker appliances, volume controls, component transformers, patch and I/O panels, wiring, supports, and other components necessary for meeting specified requirements in areas indicated on drawings.

B. Design Criteria: BICSI TDMM, including criteria and layout requirements.

C. System Description:

1) System includes integrated voice and music capability.

2) System is not emergency communications system.

3) System Type: Networked (distributed amplifiers), centralized, and decentralized (self-contained) public address systems will be considered.

4) Constant Voltage Speaker System: 70 V.

5) Features:

a) Interface to telephone system.
b) One-way paging by zone.
c) Immediate paging override.
d) Distribution of background music.
e) Selective speaker talkback.

6) System Redundancy: Redundant equipment and power supplies as indicated on drawings.

7) Include public address systems router or networking equipment where required.

D. General Requirements:

1) Provide products listed, classified, and labeled as suitable for the purpose intended.

2) Unless specifically indicated to be excluded, provide required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, and system programming, as necessary for complete operating system.

3) System Components Installed in Spaces Used for Environmental Air: Plenum rated; listed and labeled as complying with UL 2043, suitable for use in air-handling spaces.

4) Tabletop-Mounted Equipment: Include equipment stabilizing feet.

5) Performance: Audio page at least 10 dB above ambient level or perceived level that is twice ambient noise, not to exceed 20 dB over ambient noise.

E. Paging and Background Music Distribution:

1) Capable of distributing paging or background music signals simultaneously with and without interruption of signal.

2) For each amplifier or controller, provide separate volume and octave band equalization controls for paging and background music signals.

3) Integrate with telephone systems as indicated on drawings.

F. System Control and Monitoring:

1) Provide dedicated modules for interfacing and monitoring control points for each zone.

2) Provide security features to prevent unauthorized changes to or loss of system control settings.

a) Provide locked enclosure or cabinet for readily accessible electronic components.
b) Provide password protection for access to programmable controls with means for backing up settings.

3) Provide following parts-

4) Indoor IP Clock/Speaker Combo - IP-SDM

5) Indoor IP Clock/Speaker/Flasher Combo (for use in loud indoor areas) - IP-SDMF

6) Indoor IP Speaker (no display) - IP-SM

7) Supported back box for the indoor IP speakers & speaker/clock combos - IP-SEA-SD

8) PoE+ Vandal and Weather Resistant Wall Mount IP Speaker IP Speaker - IP-HVP

9) Supported back box for Weather Resistant IP Speaker - IP-SEST-HVP

10) PoE+ Weather Resistant Constant Directivity IP Horn with Rotating Bell & Wall/ Pole Mount (for outdoor use to cover large areas) - IP-APX

G. System Capacity:

1) Minimum Amplifier Wattage, Per Zone: _____.

2) Size amplifiers with 25 percent spare capacity.

3) Spare Speaker Appliance Circuit Capacity: 25 percent.

4) Secondary Power Source - Battery Storage Capacity: Provide standby operation sufficient for 24 hours.

2.3 AMPLIFIERS, CONTROLLERS, AND RELATED EQUIPMENT

A. General Requirements:

1) Provide Class D efficiency equipment.

2) System Cabinet: Rack mounted; provide associated accessories.

3) Unless otherwise noted, select integrated touchscreen controllers when product selections are available.

4) Provide equipment compatible with public address system source inputs.

5) Provide capability to support redundant power supplies where indicated.

6) Microphone Inputs: Low impedance inputs with 600 microvolt sensitivity and noise level at least 55 dB below rated output.

7) Auxiliary Inputs: High impedance input with 0.4 V sensitivity and noise level at least 70 dB below rated output.

B. Mixers:

1) Manufacturers:

a) Yamaha.
b) Allen and Heath.
c) Substitutions: See Section 016000 - Product Requirements.

2) Mix input sources.

3) Include pre-amp and power amp circuitry.

4) Master level control for output.

5) Include mic and line level inputs.

C. Amplifiers:

1) Manufacturers:

a) Substitutions: See Section 016000 - Product Requirements.

2) Include network interface for remote control and monitoring.

3) Four channels.

4) Configurable automatic gain.

5) Frequency Response: 50 to 15,000 Hz, plus/minus 2 dB.

6) Distortion: Less than 1.5 percent, 100 to 100,000 Hz at rated power.

7) Output Power: _____ Wrms.

8) Output: 4 ohms, 25 volts.

9) Include mic and line level inputs.

D. Controllers:

1) Manufacturers:

a) _____.
b) Substitutions: See Section 016000 - Product Requirements.

2) Include network interface for remote control and monitoring.

3) Support eight independent zones.

4) Routing of audio signals to appropriate zones.

5) Include ability for manual paging.

6) Master output volume and tone control.

7) Provide level of control for each input.

8) Bass: Plus 8 dB to minus 12 dB at 50 Hz.

9) Treble: Plus 8 dB to minus 12 dB at 10,000 Hz.

10) Program Selector: Provide program , listen-talk, and mode selector switches.

E. Digital Signal Processor (DSP):

1) Manufacturers:

a) _____.
b) Substitutions: See Section 016000 - Product Requirements.

2) Include network interface for remote control and monitoring.

3) Channels:

a) Input: _____, expandable to _____.

b) Output: _____, expandable to _____.

4) Provide DSP for equalization, feedback suppression, signal delay, and routing.

5) Include multi-zone capability with adjustable signal delays.

6) Features allow adjustments to audio levels and clarity based on acoustics of each zone for intelligible audio.

7) Include messaging server for simultaneous paging across multiple zones.

a) Allow announcements in one zone while other zones receive separate audio.
b) User customizable priorities determine outcomes of simultaneous paging from multiple input sources.

8) Provide output expanders for enhanced DSP capabilities.

F. --CHOOSE FROM TWO PARAGRAPHS BELOW--

G. Equipment Racks: See Section 27 1100.

H. Equipment Racks:

1) Manufacturers:

a) Middle Atlantic.
b) Substitutions: See Section 016000 - Product Requirements.

2) Equipment Mounting Width: 19 inches (483 mm).

3) Finish: Black enamel finish.

4) Include front hinged and latched door.

5) Include six receptacle multioutlet assembly inside rack.

2.4 INPUT SOURCES

A. Microphone: Desktop type low impedance microphone with push-to-talk switch.

1) Type: Wired RJ-45 or Wireless.

2) Directional Response: Unidirectional.

2.5 SPEAKER APPLIANCES

A. General Requirements:

1) Listed as suitable for installed environment.

2) Rated Sound Pressure Level: As required to achieve design sound pressure levels, but not less than 75 dB at 10 feet (3.1 m).

3) Provide speaker appliances with frequency range suitable for voice and music audio.

4) Voltage: Field configurable and matched to audio distribution circuit voltage.

a) Provide minimum of four field-selectable power taps.

5) Provide connector or termination blocks for parallel speaker connections as required.

6) Noisy Environments Over 70 dB: Utilize horn speaker appliances as indicated on drawings.

7) Provide additional DC power supply or extenders for audio amplification of loudspeaker runs; coordinate with others for associated AC power requirements.

2.6 WIRE AND CABLE

A. Microphone Cord: 20 AWG stranded copper conductor, 600 V insulation, rated 60 degrees C, two-conductor shielded cable with rubber jacket.

B. Input Source and Controller Cable: 22 AWG copper conductor, 300 V insulation, rated 60 degrees C, paired conductors twisted together, shielded, and covered with PVC jacket.

C. Speaker Wire and Cable: Copper conductor, 300 V insulation, rated 60 degrees C, paired conductors and covered with PVC jacket.

1) Minimum Conductor Size: 16 AWG.

a) Exceptions:
70 V circuits longer than 50 feet (15 m): 14 AWG, for voltage drop.
70 V circuits longer than 75 feet (23 m): 12 AWG, for voltage drop.
70 V circuits longer than 100 feet (30 m): 10 AWG, for voltage drop.
25 V circuits longer than 15 feet (5 m): 14 AWG, for voltage drop.
25 V circuits longer than 25 feet (8 m): 14 AWG, for voltage drop.
25 V circuits longer than 40 feet (12 m): 10 AWG, for voltage drop.

2) Plenum Cable for Speaker Circuits: Rated 200 degrees C, paired conductors twisted together, shielded and covered with nonmetallic jacket; suitable for use for Class 2 circuits in air handling ducts, hollow spaces used as ducts, and plenums.

2.7 ACCESSORIES

A. Sound Level Meter:

1) IEC Type 1; include new NICET calibration certificate.

2) Measures audio and acoustics in dB.

3) Provide real-time analyzer functions to review speech intelligibility and sound characteristics.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements.

B. Verify ratings and configurations of system components.

C. Verify mounting surfaces are ready to receive system components.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to system where applicable.

E. Verify conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Comply with NECA 1 for general workmanship.

B. Install products in accordance with manufacturer's instructions.

C. Splice cable only in accessible junction boxes or at terminal block units.

D. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at amplifier.

E. Install input circuits in separate cables and raceways from output circuits.

F. Leave 18 inches (300 mm) excess cable at each termination at microphone, volume pad, speaker, and other system outlet.

G. Leave 6 feet (2 m) excess cable at each termination at system cabinet

H. Provide protection for exposed cables where subject to damage.

I. Use armored cable for outside speaker circuits.

J. Support cables above accessible ceilings to keep them from resting on ceiling tiles. Use spring metal clips or plastic cable ties to support cables from structure for ceiling suspension system. Include bridle rings or drive rings.

K. Use suitable cable fittings and connectors.

L. Connect reproducers to amplifier with matching transformers.

M. Install equipment racks in location shown; arrange to provide adequate ventilation and access.

N. Provide grounding and bonding; see Section 260526.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Prepare and start system in accordance with manufacturer's instructions. Correct defective work and adjust for compliance with specified requirements.

C. Sound Level Survey:

1) Measure and record sound power levels at designated locations, areas, or zones. Test with music and voice separately to confirm operation and make measurements.

2) Comply with BICSI TDMM coverage and intelligibility principles of design and acceptance testing.

3) Include sound level survey ambient noise levels measurements at quite and peak periods. Document on floor plan drawings noting amount of reverberation in given area and contained building furnishings or obstructions. Identify spaces with hard surfaces or absorption materials that may influence concentration of speakers.

4) Utilize "A" weighting scale on sound level meter with valid NICET equipment calibration certification.

5) Clearly indicate passed or failed area based on required technical parameters.

6) Record minimum and maximum sound pressure levels (SPLs) in areas with widely varying noise levels.

7) Review for system cross-talk and interference.

D. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for closeout submittals.

B. See Section 017900 - Demonstration and Training for additional requirements.

C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.

1) Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2) Provide minimum of 6 of training.

3) Instructor: Manufacturer's authorized representative.

4) Location: At project site.

3.6 PROTECTION

A. Protect installed products from subsequent construction operations.

3.7 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Provide to Owner, as alternate to base bid, separate maintenance contract for service and maintenance of public address system for two years from mm-dd-yyyy. Include complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with detailed schedule.

C. Provide trouble call-back service upon notification by Owner:

1) Include allowance for call-back service during normal working hours at no extra cost to Owner.

2) Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

D. Maintain on-site log listing date and time of each inspection and call-back visit, condition of system, nature of trouble, correction performed, and parts replaced.

END OF SECTION

SECTION 275126
ASSISTIVE LISTENING SYSTEMS (CBC 2022/ADA 2010)

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

1.2 WORK INCLUDES

A. This specification is to be used where an Assistive Listing System is not called for within a specific audio visual system or room but is required by the CBC and/or ADA.

B. All labor, materials, appliances tools, equipment, facilities transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section. Complete as specified herein.

C. The Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system, so that the system shall perform the function listed herein compliance with all the specified requirements.

1.3 SCOPE OF WORK

A. Provide Assistive Listening Systems per CBC Section 11B.219 & 11B.706.

1) CBC 11B-219.3 Receiver Quantity based on space.

a) The minimum number of receivers to be provided shall be equal to 4 percent of the total number of seats, but in no case less than two. Twenty-five percent minimum of receivers provided, but no fewer than two, shall be hearing-aid compatible in accordance with Section 11B-706.3.

B. The Americans with Disabilities Act (ADA) 2010 ADA Standards requires public facilities to provide auditory assistance devices.
http://www.ada.gov/regs2010/2010ADAStandards/2010ADAStandards.pdf

1) Section: 706 Assistive Listening Systems

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number of Required Receivers Required to be Hearing-aid Compatible
50 or less	2	2
51 to 200	4% of the total amount of seating	25%

2.1 REFERENCES

A. Americans with Disabilities Act (ADA)

B. California Building Code (CBC)

C. National Electrical Manufacturer's Association (NEMA)

D. American National Standards Institute (ANSI)

E. National Electric Code (NEC)

F. Institute of Electrical and Electronic Engineers (IEEE)

G. Underwriters Laboratories, Inc. (UL)

1) All cabling shall comply with all appropriate requirements of NEC Articles 770 and 800 and shall comply with the State Fire Codes as interpreted by the State Fire Marshall's Dept.

2) All publications referred to in this document shall be the latest edition thereof together with any amendments and/or addenda current ten days before the date fixed for return of bids.

2.2 QUALITY ASSURANCE

A. Contractor shall assign competent person as project manager who has demonstrated the ability to supervise a project of similar size and scope. Submit a resume of the proposed Project Manager for the District's review and acceptance. The Project Manager must attend meetings as required.

B. Use adequate numbers of skilled workers thoroughly trained and experienced on the necessary crafts and completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.

C. The system Contractor shall warrant any equipment installed under this specification to be free from defect for a period of one (1) year from the date of final acceptance.

D. The contractor shall certify completion in writing and schedule the commissioning walkthrough. The contractor shall provide all the tools and personnel needed to conduct an efficient commissioning process.

E. The contractor shall coordinate with the commissioning staff and schedule appropriate walk through and testing. Testing is outlined in section 3.2 Tests and Instruction.

2.3 SUBMITTALS

A. REFER TO SUBMITTAL SECTION 013300 FOR REQUIREMENTS.

B. Provide product data for the following:

1) Manufacturers cut sheets, specifications and installation instructions for all products.

PART 2 PRODUCTS

3.1 ASSISTIVE LISTENING SYSTEMS

A. Furnish and install an FM wireless assistive listening system for use by the hearing-impaired. The assistive listening system (ALS) shall be capable of broadcasting on 57 channels and be frequency agile. The ALS system shall have 80dB SNR or greater, end-to-end. Receivers shall be frequency agile and frequency set with a "seek" button. The receiver will incorporate a stereo headset jack that allows the user to plug into a 1/8" mono jack and listen to audio normally. The portable receivers and transmitters shall incorporate automatic battery charging circuitry for recharging of Ni-MH batteries. Listen Technologies Corporation products are specified. Approved equals; Williams Sound, Shure, Phonic Ear , Telex and Sennhieser of equal type and quantities.

B. Also include:

C. - Assistive listening systems shall be capable of providing a sound pressure level of 110 dB minimum and 118 dB maximum with a dynamic range on the volume control of 50 dB. (11B-706.4)

D. -Peak clipping shall not exceed 18 dB of clipping relative to the peaks of speech. (11B-706.6)

E. Minimum system requirements (assembly area 50 or less)

1) Listen Technologies LT-800-072 Base Transmitter (Qty: 1 ea.)

2) Listen Technologies LA-326 Rack mount kit (Qty: 1 ea.).

3) Listen Technologies LA-122 Universal antenna. (Qty: 1 ea.) Mount as needed, can be mounted on ceiling, wall, and remote base or flexible dipole. If antenna is to be remote mounted use RG58 for less than 100ft or RG8 for more than 100ft runs (50 0hm).

4) Listen Technologies LR-400-072 Portable Display receiver (Qty: 2 each or as needed, see note*)

5) Listen Technologies LA-164 Ear Speaker (Qty: 2 ea.)

6) Listen Technologies LA-166 Neckloop. (Qty: 2 ea.)

7) Listen Technologies LA-321 8 unit charging carrying case. (Qty: 1 ea.)

8) Listen Technologies LA-362 Ni-MH rechargeable batteries (Qty: 4 ea.)

9) Listen Technologies LA-304 ADA Access/Compliance signage kit. (Qty 1 ea.)

F. Contractor to provide additional equipment as required by ADA assembly area table.

G. The Contractor shall provide coordination until proper functionality of the system is complete and accepted by the District Representative.

PART 3 EXECUTION

4.1 INSTALLATION

A. The installation shall be accomplished by and under the direction of skilled electronic craftsmen, factory trained by the equipment manufacturer, and experienced in the installation of systems of this type in the State of California. Workmanship shall be of the highest quality.

B. All wiring shall be neat and orderly. Disorganized "rats nests" of wire and cable will not be allowed. Terminal punch blocks and patch panels should be used for all system wire connections wherever possible, and all connections must be accessible. Absolutely no connections are to be made in wet locations or below grade.

C. The conduit, outlet boxes, terminal cabinets, etc., which form a part of the roughin work shall be furnished and installed complete as described and otherwise required in other sections of this Division 26 00 00 Specification.

D. The balance of the system, including installation of the communication equipment, making all connections, etc., shall be performed by the manufacturer's authorized representative, and the entire responsibility for the proper operation, function, testing and complete maintenance for two (2) years after final acceptance by the Owner, shall be the responsibility of this subcontractor.

E. During preparation for installation of any of the systems described in this Section of these Specifications and prior to ordering any material, coordinate all options and requirements with the Owner.

F. Provide and install all cables as required specifically for each installation as needed for a complete and operable installation

4.2 TESTS AND INSTRUCTION

A. The entire system shall be tested and adjusted under the supervision of the Contractor's electronics engineer.

1) Program all control functions as needed. Coordinate all optional features of all systems with the Owner

2) Any defects or abnormalities shall be corrected at once and the test reconducted to demonstrate proper operation.

3) A complete report of all these tests shall be prepared by the testing personnel and signed by them. The report shall include the date the testing was conducted a narrative describing each test and the results of all testing upon correction of all defects. The site inspector shall be informed of the testing schedule and his signature shall appear on the report attesting to the fact that these tests were conducted. The original copy of the final signed report shall be submitted to the Architect; and following his review, copies of the report shall be included in the operations and maintenance manuals provided to the Owner.

B. The equipment supplier/installer shall instruct the Owner or his designated representative(s) in the proper operation and maintenance of the system. Allow a minimum of four (4) hours for this onsite "handson" instruction. The Electronics Contractor shall provide sufficient personnel to provide adequate operations and maintenance training for all aspects of the system to the school staff.

1) Approximately 30 days after final acceptance of the system, or as requested by the Owner, a follow up training session shall be scheduled at the site. Any special operating problems shall be resolved and the system shall be fully checked out and "finetuned" as required.

2) Allow a minimum of four (4) hours on site for the instruction portion of this requirement.

END OF SECTION

SECTION 281000
ACCESS CONTROL

PART 2 PRODUCTS

1.1 ACCESS CONTROL SYSTEM REQUIREMENTS

A. Provide new Verkada access control system consisting of required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

1) Verkada Access Control Units and Readers: Listed and labeled as complying with UL 294.

1.2 ACCESS CONTROL UNITS AND SOFTWARE

A. Provide access control units and software compatible with readers to be connected.

B. Unless otherwise indicated, provide software and licenses required for fully operational system.

1.3 ACCESS CONTROL POINT PERIPHERALS

A. Provide devices compatible with control units and software.

B. Provide devices suitable for operation under the service conditions at the installed location.

C. Door Locking Devices (Electric Strikes and Magnetic Locks): Comply with Section 087100.

END OF SECTION

SECTION 282000
VIDEO SURVEILLANCE

PART 2 PRODUCTS

1.1 VERKADAVIDEO SURVEILLANCE SYSTEM

A. Provide new Verkada video surveillance system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. System Description: Verkada IP system with connection to network (IP) cameras.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

END OF SECTION

SECTION 283100
FIRE ALARM SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Divisions 0 and 1 and Sections 26 6000 and 26 7000 Specifications, apply to work of this Section

1.2 SECTION INCLUDES

A. Emergency evacuation fire alarm system.

1.3 REFERENCE STANDARDS

A. NFPA 12 - Standard on Carbon Dioxide Extinguishing Systems; 2025.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 15 - Standard for Water Spray Fixed Systems for Fire Protection; 2022.

D. NFPA 17A - Standard for Wet Chemical Extinguishing Systems; 2024.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

H. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 750 - Standard on Water Mist Fire Protection Systems; 2023.

J. NFPA 2001 - Standard on Clean Agent Fire Extinguishing Systems; 2025.

K. NFPA 5000 - Building Construction and Safety Code; 2024.

L. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

M. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

N. UL 1971 - Standard for Signaling Devices for the Hearing Impaired; Current Edition, Including All Revisions.

O. UL 2572 - Mass Notification Systems; Current Edition, Including All Revisions.

1.4 REFERENCES

A. State Codes

1) 2022 California Electrical Code (C.E.C.), Part 3, Title 24 C.C.R. (2020National Electrical Code and California Amendments)

2) 2022 California Fire Code (C.F.C.) Part 9, Title 24 C.C.R. (2021 International Fire Code and California Amendments)

B. National Fire Protection Association (NFPA):

1) NFPA 12 – Standard on Carbon Dioxide Extinguishing Systems.

2) NFPA 13 – Installation of Sprinkler Systems.

3) NFPA 15 – Standard for Water Spray Fixed Systems for Fire Protection.

4) NFPA 16 – Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems.

5) NFPA 16A – Standard for the Installation of Closed Head Foam-Water Sprinkler Systems.

6) NFPA 17A – Wet Chemical Extinguishing Systems

7) NFPA 70 – National Electrical Code (NEC).

8) NFPA 72 – National Fire Alarm Code.

9) NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems.

10) NFPA 101 – Life Safety Code.

11) NFPA 750 – Standard on Water Mist Fire Protection Systems.

12) NFPA 5000 – Building Construction and Safety Code.

C. Underwriters Laboratories (UL):

1) UL 268 – Standard for Smoke Detectors for Fire Alarm Signaling Systems.

2) UL 864 – Standard for Control Units and Accessories for Fire Alarm Systems.

3) UL 1971 – Standard for Signaling Devices for the Hearing Impaired.

1.5 SYSTEM DESCRIPTION

A. A new intelligent reporting, Style 7 networked, fully peer-to-peer, microprocessor-controlled fire detection and emergency voice alarm communication system shall be installed in accordance with the specifications and as indicated on the Drawings.

B. Each Signaling Line Circuit (SLC) and Notification Appliance Circuit (NAC): Limited to only 80 percent of its total capacity during initial installation.

C. Basic Performance:

1) Network Communications Circuit (NetSOLO) Serving Network Nodes: Wired using single twisted non-shielded 2-conductor cable or connected using approved fiber optic cable between nodes in Class A configuration.

2) Signaling Line Circuits (SLC) Serving Addressable Devices: Wired Class A.

3) Initiation Device Circuits (IDC) Serving Non-addressable Devices Connected to Addressable Monitor Modules: Wired Class A.

4) Notification Appliance Circuits (NAC) Serving Strobes, Horns and Speakers: Wired Class A.

5) On Class A Configurations: Single ground fault or open circuit on Signaling Line Circuit shall not cause system malfunction, loss of operating power, or ability to report an alarm.

6) Alarm Signals Arriving at INCC COMMAND CENTER: Not be lost following primary power failure until alarm signal is processed and recorded.

7) Transponders:

   a) Operate in peer-to-peer fashion with other panels and transponders in system.
   b) Each transponder shall store copy of audio evacuation messages and tones.
   c) Systems that use centralized message storage and control at main fire alarm control panel shall not be acceptable.

8) Network Node Communications, Audio Evacuation Channels and Fire Phone Communications:

   a) Communicated between panels and transponders on single twisted pair of copper wires or fiber optic cables.
   b) To enhance system survivability, ability to operate on loss of INCC Command Center, short or open of entire riser at INCC Command Center shall be demonstrated at time of system acceptance testing.
   c) Systems that are not capable of providing true Class A performance for fire fighter's phone communications shall not be acceptable.

9) Signaling Line Circuits (SLC):

   a) Reside in remote transponders with associated audio zones.
   b) SLC modules shall operate in peer-to-peer fashion with all other panels and transponders in system.
   c) On loss of INCC Command Center, each transponder shall continue to communicate with remainder of system, including all SLC functions and audio messages located in all transponders.
   d) Systems that provide a "Degraded" mode of operation upon loss of INCC Command Center or short in riser shall not be acceptable.

10) Audio Amplifiers and Tone-Generating Equipment: Electrically supervised for normal and abnormal conditions.

11) Amplifiers: Located in transponder cabinets serving no more that 3 floors per transponder to enhance system survivability, reduce required riser wiring, simplify installation, and reduce power losses in length of speaker circuits.

12) Speaker NAC Circuits: Arranged such that there is a minimum of 1 speaker circuit per fire alarm zone.

13) Notification Appliance Circuits (NAC), Speaker Circuits, and Control Equipment: Arranged such that loss of any 1 speaker circuit will not cause loss of any other speaker circuit in system.

14) Speaker Circuits:

   a) Electrically supervised for open and short circuit conditions.
   b) If short circuit exists on speaker circuit, it shall not be possible to activate that circuit.
   c) Arranged for 25 or 70 VRMS and shall be power limited in accordance with NEC
   d) 20 percent spare capacity for future expansion or increased power output requirements.

15) Speaker Circuits and Control Equipment:

a) Arranged such that loss of any 1 speaker circuit will not cause loss of any other speaker circuit in system.
b) Systems utilizing “bulk” audio configurations shall not be acceptable.

16) 2-Way Telephone Communication Circuits:

a) Shall communicate digitally over the network between transponders.
b) Supervised for open and short circuit conditions.
c) Short circuit condition on 2-way telephone communications circuit shall result in trouble condition and not result in call-in condition.

17) Voice Communication:

a) Connect telephone circuits to speaker circuits to allow voice communication over speaker circuit from telephone handset.
b) Capable of remote phone-to-phone conversations and party-line communications as required.

D. Basic System Functional Operation: When fire alarm condition is detected and reported by 1 of the system alarm initiating devices, the following functions shall immediately occur:

1) System Alarm LEDs: Flash.

2) Local Piezo-Electric Signal in Control Panel: Sound at a pulse rate.

3) 80-Character LCD Display: Indicate all information associated with fire alarm condition, including type of alarm point and its location within protected premises.

4) Historical Log: Record information associated with fire alarm control panel condition, along with time and date of occurrence. History Log shall have capacity for recording up to 4,100 events.

5) System output programs assigned via control-by-event equations to be activated by particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

a) Close Fire Doors
b) Shot down air handlers as required by code
c) Notify the Central Station or Municipal Tie.

6) Strobes flash synchronized continuously.

7) Audio Portion of System: Sound alert tone followed by pre-recorded message determined by event and this scenario repeating or other message as approved by local authority until system is reset.

E. Fire Alarm System Functionality:

1) Provide complete, electrically supervised distributed, Class A networked analog/addressable fire alarm and control system, with analog initiating devices, integral multiple-channel voice evacuation, and fire fighter’s phone system.

2) Fire Alarm System:

a) Consist of multiple-voice channels with no additional hardware required for total of 4 channels.
b) Incorporate multiprocessor-based control panels, including model E3 Series modules includes Intelligent Network INCC Command Center(s) (INCC), Intelligent Loop Interface (ILI-

MB-E3 or ILI95-MB-E3), Intelligent Network Transponders (INX), communicating over peer-to-peer token ring network with standard capacity of up to 64 nodes expandable to 122.

3) Each ILI-MB-E3 or ILI95-MB-E3 Node: Incorporate 2 Signaling Line Circuits (SLC), with capacity to support in Velociti ® mode up to 159 analog addressable detectors and 159 addressable modules per ILI-MB-E3 SLC or support in Apollo mode up to 126 detectors and modules per ILI95-MB-E3 SLC.

4) Voice, Data, and Fire Fighter's Phone Riser: Transmit over single pair of wires or fiber optic cable.

5) Each Intelligent Network Transponder: Capable of providing 16 distributed voice messages, fire fighter phones connections, SLC loop for audio control devices, and integral network interface.

6) Each Network Node: Incorporate Boolean control-by-event programming, including as a minimum AND, OR, NOT, and Timer functions.

7) Control Panels: Capability to accept firmware upgrades via connection with laptop computer, without requirement of replacing microchips.

8) Network:

   a) Based on peer-to-peer token ring technology operating at 625 K baud, using Class A configuration.
   b) Capability of using twisted-pair wiring, pair of fiber optic Multi-mode cable strands up to 200 microns or Single-mode optimized for 9/125 microns, or any combination, to maximize flexibility in system configuration.

9) Each Network Node:

   a) Capability of being programmed off-line using Windows-based software supplied by fire alarm system manufacturer. Capability of being downloaded by connecting laptop computer into any other node in system. Systems that require system software to be downloaded to each transponder at each transponder location shall not be acceptable.
   b) Capability of being grouped with any number of additional nodes to produce a "Region", allowing that group of nodes to act as 1, while retaining peer-to-peer functionality. Systems utilizing "Master/Slave" configurations shall not be acceptable.
   c) Capability of annunciating all events within its "Region" or annunciating all events from entire network, on front panel LCD or touchscreen display without additional equipment.

10) Each SLC Network Node: Capability of having integral DACT (Digital Alarm Communicator Transmitter) that can report events in either its region, or entire network to single central station monitoring account.

11) Each Control Panel: Capability of storing its entire program, and allow installer to activate only devices that are installed during construction, without further downloading of system.

12) Password Protection: Each system shall be provided with 4 levels of password protection with up to 16 passwords.

13) Have the capacity for multiple pre-recorded messages (at least sixteen (16), but more if required by local AHJ) and address a list of subjects.

   a) Fire evacuation and relocation
   b) Intruder or hostile person sighted within or around the building grounds
   c) Directions to occupants to take cover within building
   d) Emergency weather conditions appropriate for local area

e) All Clear

1.6 SUBMITTALS

A. Comply with Section 01330 (01 33 00) – Submittal Procedures.

B. Include sufficient information, clearly presented, to determine compliance with the specifications and the Drawings.

C. Equipment Submittals:

1) Cover Page: Indicate the following:

a) Project name and address.
b) Engineered systems distributor's name and other contact information.
c) Installing contractor's name and other contact information.
d) Date of equipment submittals. Indicate on revised submittals the original submittal date and revised submittal date.

2) Table of Contents: Lists each section of equipment submittal.

3) Scope of Work Narrative: Detail indented scope of work.

4) Sequence of Operations: Use matrix or written text format, detailing activation of each type of device and associated resulting activation of the following:

a) Control panel.
b) Annunciator panels.
c) Notification appliances.
d) Building fire safety functions, including elevator recall, elevator power shutdown, door lock release, door holder release, HVAC unit shutdown, smoke evacuation system activation, and stair pressurization fan activation.

5) Bill of Material: Indicate for each component of system the following:

a) Quantity.
b) Model number.
c) Description.

6) SLC Circuit Schedule: Detail address and associated description of each addressable device. Clearly provide information that indicates number of both active and spare addresses.

7) Battery Calculations: Show load of each of, and total of, components of system along with standby and alarm times that calculations are based on. Show calculated spare capacity and size of intended battery.

D. Shop Drawings:

1) Cover Page: Indicate the following:

a) Project name and address.
b) Engineered systems distributor's name and other contact information.
c) Installing contractor's name and other contact information.
d) Date of equipment submittals. Indicate on revised submittals the original submittal date and revised submittal date.

2) Floor Plans:

a) Provide separate floor plan for each floor.

b) If a floor plan must be split using match lines to fit on the page, provide match lines and match line references that refer to sheet number that shows area on opposite side of match line.
c) Prepare using AutoCAD.
d) Prepare to scale 1/8 inch (3.18 mm) = 1'-0", unless otherwise required by the Architect or Engineer.
e) Show equipment and device locations.
f) Show wiring information in point-to-point format.
g) Show conduit routing, if required by the AHJ.

3) Title Block: Provide on each sheet and include, at a minimum, the following:

a) Project name.
b) Project address.
c) Sheet name.
d) Sheet number.
e) Scale of drawing.
f) Date of drawing.
g) Revision dates, if applicable.

4) Control Panel: Provide sheet that details exterior and interior views of control panel and clearly shows associated wiring information.

5) Annunciator Panels: Provide sheet that details exterior and interior views of annunciator panels and clearly shows associated wiring information.

E. Certification: Submit with equipment submittals and shop drawings, letter of certification from major equipment manufacturer, indicating proposed engineered system distributor is an authorized representative of major equipment manufacturer.

F. Project Record Drawings:

1) Submit complete project record drawings within 14 calendar days after acceptance test.

2) Project record drawings shall be similar to shop drawings, but revised to reflect changes made during construction.

G. Operation and Maintenance Manuals:

1) Submit complete operation and maintenance manuals within 14 calendar days after acceptance test.

2) Operation and maintenance manuals shall be similar to equipment submittals, but revised to reflect changes made during construction.

3) Include factory's standard installation and operating instructions.

1.7 QUALITY ASSURANCE

A. Codes and Standards:

1) NFPA: System shall comply with the following NFPA codes and standards:

a) NFPA 12.
b) NFPA 13.
c) NFPA 15.

d) NFPA 16.
e) NFPA 16A.
f) NFPA 70.
g) NFPA 72.
h) NFPA 2001
i) NFPA 90A.
j) NFPA 101.
k) NFPA 750.
l) NFPA 5000.

2) ADA: System shall conform to American with Disabilities Act (ADA).

B. To ensure reliability and complete compatibility, all items of fire alarm system, including control panels, power supplies, initiating devices, and notification appliances, shall be listed by Underwriters Laboratories Inc. (UL) and shall bear “UL” label.

C. Fire Alarm Control Panel Equipment: UL-listed under UL 864 Ninth Edition and UL 2572.

D. Equipment, Programming, and Installation Supervision:

1) Provide services of approved Platinum Level engineered systems distributor of Gamewell-FCI for equipment, programming, and installation supervision.

2) Provide proof of factory training within 14 calendar days of award of the Contract.

E. Software Modifications:

1) Provide services of Platinum Level Gamewell-FCI factory-trained and authorized technician to perform system software modifications, upgrades, or changes.

2) Provide use of all hardware, software, programming tools, and documentation necessary to modify fire alarm system software on-site.

3) Modification includes addition and deletion of devices, circuits, zones, and changes to system operation and custom label changes for devices or zones.

4) System structure and software shall place no limit on type or extent of software modifications on-site.

5) Modification of software shall not require power-down of system or loss of system fire protection while modifications are being made.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer’s instructions.

C. Handling: Protect materials from damage during handling and installation.

1.9 COORDINATION

A. Coordinate the Work of this section with the Work of other sections, HVAC systems as specified in Section 230001.

1.10 WARRANTY

A. Warranty Period for System Equipment: 1 year from date of final acceptance.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Gamewell-FCI, Honeywell Fire Systems, 12 Clintonville Road, Northford, Connecticut 06472. Phone (203) 484-7161. Fax (203) 484-7118. Website: www.gamewell-fci.com.

B. References to manufacturer's model numbers and other information is intended to establish minimum standards of performance, function, and quality. Equivalent equipment from Gamewell may be substituted for the specified equipment, as long as minimum standards are met. No other manufacturers, other than Gamewell-FCI, FCI, and Gamewell will be considered for use on this project.

C. Substitute equipment proposed as equal to equipment specified shall meet or exceed requirements of this section. For equipment other than Gamewell-FCI E3 Series Expandable Emergency Evacuation Fire Alarm System, provide proof that such substitute equipment equals or exceeds features, functions, performance, and quality of specified equipment. This proof shall be provided by submission of a copy of specification with each copy of the submittals that has had each paragraph marked as either compliant or non-compliant along with a letter from engineering manager or product manager at factory that certifies information presented as either compliant or non-compliant including a detailed explanation of each paragraph identified as non-compliant. In order to ensure that the Owner is provided with a system that incorporates required survivability features, this letter shall also specifically certify that the system is capable of complying with the test requirements of this section.

2.2 DISTRIBUTED NETWORKED FIRE ALARM SYSTEM

A. Distributed Networked Fire Alarm System: Gamewell-FCI E3 Series Expandable Emergency Evacuation Fire Alarm System.

2.3 INTELLIGENT NETWORK INCC COMMAND CENTER HARDWARE

A. Intelligent Network INCC Command Center (INCC): Supply user interface, including LCD or touch-screen 1/4 VGA display Intelligent Loop Interface Modules (ILI-MB-E3/ILI95-MB-E3), manual switching, phone, and microphone inputs to the network. INCC shall consist of the following units and components:

1) System Cabinet (B-, C-, or D-Size Cabinet) with associated inner door.

2) Power Supply Module (PM-9) with batteries.

3) Intelligent Network Interface Voice Gateway (INI-VG).

4) 80-Character LCD Display (LCD-E3).

5) Intelligent Loop Main Board Interface (ILI-MB-E3 or ILI95-MB-E3).

6) Optional Intelligent Loop Supplemental Interface (ILI-S-E3 or ILI95-S-E3).

7) Optional DACT (DACT-E3).

8) Optional ARCNET Repeater (RPT-E3) with fiber-optic modules (FSL-E3 or FML-E3).

9) Optional 1/4 VGA touch-screen display (NGA).

10) Optional Auxiliary Switch Module (ASM-16).

11) Optional LED Driver Module (ANU-48)

12) Optional Microphone Assembly (INCC-MIC).

13) Optional Telephone Assembly (INCC-TEL).

14) Optional AM-50 Series amplifiers (AM-50, AM-50-70).

15) Optional Addressable Node Expander (ANX-SR, ANX-MR-FO, ANX-MR-UTP).

B. System Cabinet:

1) Surface or semi-flush mounted with texture finish.

2) Consist of back box, inner door, and door.

3) Available in at least 3 sizes to best fit project configuration.

4) Houses 1 or more PM-9 Power Supply Modules, INI-VG Intelligent Network Interface Voice Gateway, 1 or more ILI-MB-E3/ILI95-MB-E3 assemblies, and other optional modules as specified.

5) Construction: Dead-front steel construction with inner door to conceal internal circuitry and wiring.

6) Wiring Gutter Space: A minimum of 1-inch wiring gutter space behind mounting plate.

7) Wiring: Terminated on removable terminal blocks to allow field servicing of modules without disrupting system wiring.

C. Power Supply Module (PM-9): Use latest technologies to provide system power, incorporates the following features:

1) Power-saving switching technology using no step-down transformers.

2) 9-amp continuous-rated output to supply up to all power necessary under normal and emergency conditions for INCC Command Center Modules.

3) Integral battery charger with capacity to charge up to 55 amp-hour batteries while under full load.

D. Batteries:

1) Sufficient capacity to provide power for entire system upon loss of normal AC power for a period of 24 hours with 15 minutes of alarm signaling at end of this 24-hour period, as required by NFPA 72, Local Systems.

E. Intelligent Network Interface Voice Gateway INCC Command Center (INI-VG): INI-VG shall be a multi-function board interchangeable in both INCC and INX. Functions of board shall have the following features as a minimum:

1) Microprocessor shall monitor all system events and perform all system programs, for all control-by-event (CBE) functions. System program shall not be lost upon failure of both primary and secondary power. Programming shall supporting Boolean logic including AND, OR, NOT, TIMING functions for maximum flexibility.

2) Network Interface: Operate at 625 K baud configurable with any combination of wire and/or fiber topologies. Interface shall communicate with up to122 nodes in peer-to-peer fashion.

3) Fire Fighter Phone Riser: INI-VG shall generate local phone riser for use with AOM-TEL phone modules for connection to fire fighter phone stations and/or for connection of local phone when used as INCC Command Center, including phone circuits. INI-VG shall mix its local phone riser to network in true Class A fashion. Systems not capable of true Class A communications for fire fighter's phone risers shall not be acceptable.

4) Advanced Processing: INI-VG shall incorporate latest in digital signaling processing technology with supporting Boolean logic including AND, OR, NOT, TIMING, COUNT, SCHEDULE functions.

5) Microphone Input: On-board and allow for addition of local microphone when used as INCC Command Center, including speaker circuit control.

6) Signal Processing: INCC shall use advanced Digital Signal Processing (DSP) technology to allow maximum flexibility of digital audio and control capabilities and operation. Signals to and from INCC shall be transmitted over single pair of twisted unshielded wire or fiber optic pair.

7) Field Programmable: INCC shall be capable of being fully programmed or modified by Field Configuration Program (FCP), to be downloaded via portable computer from any node in system.

8) Control-by-Event Programming (CBE): INCC shall be capable of programming using Boolean logic including AND, OR, NOT, COUNT, TIMING, and SCHEDULE functions to provide complete programming flexibility.

9) Remote INCC Command Center Options: System shall have capability of adding remote INCC Command Centers or re-locating INCC Command Centers utilizing only single pair of twisted unshielded wire or fiber optic pair for all functions.

10) RS-485 Serial Output: System shall incorporate RS-485 bus via ribbon harness for connection of modules inside same cabinet, and via 4-wire quick connector for connection of modules up to 3,000 feet (91440 cm) from cabinet.

11) Riser Wiring: All data, voice, and fire fighter phone riser shall transmit over single pair of twisted unshielded wire or fiber optic pair for all functions configured in Class A format. Any short or open in data, voice, or phone sections shall not affect transmission over remainder of network.

12) Class A Network: All communication between control panels and transponders shall be through supervised Style 7 token passing network. In event of single short, open, or ground, all system communication shall operate as normal and report fault. This protection shall incorporate all data, voice, and fire fighter phone transmissions. Upon single short, open, or ground of either system data, live voice, pre-recorded channels, or phone risers, the function of each of these items shall continue to operate. "Degrade" functionality shall not be acceptable. This shall be demonstrated at system acceptance.

F. LCD Display Module (LCD-E3):

1) LCD Display: 80-character RS-485 based textual annunciator with capability of being mounted locally or remotely. Provides audible and visual annunciation of all alarms and trouble signals. Provide dedicated LEDs for:

a) AC Power On: Green.
b) Alarm: Red.
c) Supervisory: Yellow.

d) System Trouble: Yellow.
e) Power Fault: Yellow.
f) Ground Fault: Yellow.
g) System Silenced: Yellow.

2) 80-Character Alphanumeric Display: Provide status of all analog/addressable sensors, monitor and control modules. Display shall be liquid crystal type (LCD), clearly visible in dark and under all light conditions.

3) Panel shall contain 4 functional keys:

a) Alarm Acknowledge.
b) Trouble Acknowledge.
c) Signal Silence.
d) System Reset/Lamp Test.

4) Panel shall contain 3 configuration buttons:

a) Menu/Back.
b) Back Space/Edit.
c) OK/Enter.

5) Panel shall have 12-key telephone-style keypad to permit selection of functions.

G. Intelligent Loop Interface (ILI-MB-E3/ILI95-MB-E3): System shall be of multiprocessor design to allow maximum flexibility of capabilities and operation. Intelligent Loop Interface shall be capable of mounting in stand-alone enclosure or integrated with Intelligent Network INCC Command Center (INCC) as specified.

1) Field Programmable: System shall be capable of being programmed by Field Configuration Program (FCP), allowing programming to be downloaded via portable computer from any node on network.

2) RS-232C Serial Output: Supervised RS-232C serial port shall be provided to operate remote printers and/or video terminals, accept downloaded program from portable computer, or provide 80-column readout of all alarms, troubles, location descriptions, time, and date. Communication shall be standard ASCII code operating from 1,200 to 115,200 baud rate.

3) RS-485 Serial Output: Each ILI-MB-E3/ILI95-MB-E3 shall incorporate RS-485 bus via ribbon harness for connection of modules inside same cabinet, and via 4-wire quick connector for connection of modules up to 3,000 feet (91440 cm) from cabinet. RS-485 bus shall support up to 16 ASM-16 auxiliary switch modules, 6 LCD-E3 main annunciators, and 5 LCD-7100 annunciators.

4) Peer-to-Peer Panel Configuration: All Loop Interface Modules shall incorporate own programming, log functions, Central Processor Unit, and control-by-event (CBE) programming. If any loop becomes disabled, each remaining loop driver shall continue to communicate with remainder of network and maintain normal operation. “Degrade” configurations under these conditions shall not be acceptable.

5) Control-by-Event (CBE) Program: ILI-MB-E3/ILI95-MB-E3 shall be capable of programming using Boolean logic including AND, OR, NOT, TIMING, COUNT, SCHEDULE functions to provide complete programming flexibility.

6) Alarm Verification: Smoke detector alarm verification shall be standard option while allowing other devices such as manual stations and sprinkler flow to create immediate alarm. This feature shall be selectable for smoke sensors that are installed in environments prone to nuisance or unwanted alarms.

7) Alarm Signals: All alarm signals shall be automatically latched or "locked in" at control panel until operated device is returned to normal and control panel is manually reset. When used for sprinkler flow, "SIGNAL SILENCE" switch may be bypassed, if required by AHJ.

8) Electrically Supervised:

   a) Each SLC and NAC circuit shall be electrically supervised for opens, shorts, and ground faults. Occurrence of fault shall activate system trouble circuitry, but shall not interfere with proper operation of other circuits.
   b) Yellow "SYSTEM TROUBLE" LEDs shall light and system audible sounder shall steadily sound when trouble is detected in system. Failure of power, open or short circuits on SLC or NAC circuits, disarrangement in system wiring, failure of microprocessor or any identification module, or system ground faults shall activate this trouble circuit. Trouble signal shall be acknowledged by operating "TROUBLE ACKNOWLEDGE" switch. This shall silence sounder. If subsequent trouble conditions occur, trouble circuitry shall resound. During alarm, all trouble signals shall be suppressed with exception of lighting yellow "SYSTEM TROUBLE" LEDs.

9) Drift Compensation – Analog Smoke Sensors: System software shall automatically adjust each analog smoke sensor approximately once each week for changes in sensitivity due to effects of component aging or environment, including dust. Each sensor shall maintain its actual sensitivity under adverse conditions to respond to alarm conditions while ignoring factors which generally contribute to nuisance alarms. System trouble circuitry shall activate, display "DIRTY DETECTOR" and "VERY DIRTY DETECTOR" indications and identify individual unit that requires maintenance.

10) Analog Smoke Sensor Test: System software shall automatically test each analog smoke sensor a minimum of 3 times daily. Test shall be recognized functional test of each photocell (analog photoelectric sensors) and ionization chamber (analog ionization sensors) as required annually by NFPA 72. Failure of sensor shall activate system trouble circuitry, display "Test Failed" indication, and identify individual device that failed.

11) Off-Premises Connection:

   a) Fire Alarm System: Connect via leased telephone lines to central station or remote station.
   b) Fire Alarm System: Connect to local energy city master box.
   c) Fire Alarm System: Connect via Digital Alarm Communicator Transmitter (DACT) and telephone lines to central station or remote station. Panel shall contain disconnect switch to allow testing of system without notifying fire department.

12) Remote Station Option: Fire department shall be consulted regarding authorized remote station serving municipality. Fire alarm system shall transmit alarm, supervisory, and trouble signals with alarm having priority over supervisory and trouble signals. Required phone lines shall be provided and installed between incoming telephone service and fire alarm system by Owner's telephone contractor under separate contract. Owner will be responsible for phone company costs.

13) Local Energy City Master Box Option: Fire alarm system shall be connected to local energy city master box. City master box shall be coded and timed in accordance with requirements of fire department. Box shall be surface or flush mounted and located as specified by building engineer and fire department.

14) Central Station Option: Fire alarm control panel shall provide integral Digital Alarm Communicator Transmitter (DACT) for signaling to central station. DACT shall contain "Dialer-Runaway" feature preventing unnecessary transmissions as result of intermittent faults in system and shall be Carrier Access Code (CAC) compliant, accepting up to 20-digit central station telephone numbers. The Fire department shall be consulted as to the authorized central station

companies serving the municipality. Fire alarm system shall transmit both alarm and trouble signals, with alarm having priority over trouble signal. Contractor shall be responsible for all installation charges and Owner will be responsible for line lease charges.

15) Network Annunciator Option: Each ILI-MB-E3 or ILI95-MB-E3 and associated display shall provide option of being configured as network annunciator. Options for annunciation shall default as regional annunciator with capability of selecting global annunciation to provide system-wide protection and Acknowledge, Silence, and Reset capabilities.

16) Redundant History Log: Each ILI-MB-E3 or ILI95-MB-E3 shall contain full 4100 event history log supporting local and network functions. If a main processor or network node is lost the entire log shall be accessible at any other Loop Interface board. This shall be demonstrated by removing power from INCC Command Center followed by extraction of history log from any loop driver location, including INCC Command Center or Transponder.

17) LEDs Indicator and Outputs: Each ILI-MB-E3/ILI95-MB-E3 Loop Interface shall incorporate as a minimum the following diagnostic LED indicators:

    a) Power: Green.
    b) Alarm: Red.
    c) Supervisory: Yellow.
    d) General Trouble: Yellow.
    e) Ground Fault: Yellow.
    f) Transmit: Green.
    g) Receive: Green.

18) Auxiliary Power Outputs: Each ILI-MB-E3/ILI95-MB-E3 Loop Interface shall provide the following supply outputs:

    a) 24 VDC non-resettable, 1 amp. maximum, Class A power-limited.
    b) 24 VDC resettable, 1 amp. maximum, Class A power-limited.

19) Microprocessor: Loop interface shall incorporate 32-bit RISC processor. Isolated “watchdog” circuit shall monitor microprocessor and upon failure shall activate system trouble circuits on display. Microprocessor shall access system program for all control-by-event (CBE) functions. System program shall not be lost upon failure of both primary and secondary power. Programming shall support Boolean logic including AND, OR, NOT, TIME DELAY functions for maximum flexibility.

20) Auto Programming: System shall provide for all SLC devices on any SLC loop to be pre-programmed into system. Upon activation of auto programming, only devices that are present shall activate. This allows for system to be commissioned in phases without need of additional downloads.

21) Environmental Drift Compensation: System shall provide for setting Environmental Drift Compensation by device. When detector accumulates dust in chamber and reaches unacceptable level but yet still below allowed limit, control panel shall indicate maintenance alert warning. When detector accumulates dust in chamber above allowed limit, control panel shall indicate maintenance urgent warning.

22) NON-FIRE Alarm Module Reporting: Non-reporting type ID shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display message at panel LDC. Activation of NON-FIRE point shall activate control by event logic, but shall not cause indication on control panel.

23) 1-Man Walk Test:

a) System shall provide both basic and advanced walk test for testing entire fire alarm system. Basic walk test shall allow single operator to run audible tests on panel. All logic equation automation shall be suspended during test and while annunciators can be enabled for test, all shall default to disabled state. During advanced walk test, field-supplied output point programming shall react to input stimuli, such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch input. Advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device, and wiring operation/verification.

b) Test feature is intended to provide for certain random spot testing of system and is not intended to comply with requirements of testing fire alarm systems in accordance with NFPA 72, as it is impossible to test all functions and verify items such as annunciation with only 1 person.

24) Signaling Line Circuits: Each ILI-MB-E3 module shall provide communication with analog/addressable (initiation/control) devices via 2 signaling line circuits. Each signaling line circuit shall be capable of being wired Class B, Style 4 or Class A, Style 6. Circuits shall be capable of operating in NFPA Style 7 configuration when equipped with isolator modules between each module type device and isolator sensor bases. Each circuit shall communicate with a maximum of 159 analog sensors and 159 addressable monitor/control devices. Unique 40-character identifier shall be available for each device. Devices shall be of the Velocity series with capability to poll 10 devices at a time with a maximum polling time of 2 seconds when both SLCs are fully loaded.

25) Notification Appliance Circuits: 2 independent NAC circuits shall be provided on ILI-MB, polarized and rated at 2 amperes DC per circuit, individually over current protected and supervised for opens, grounds, and short circuits. They shall be capable of being wired Class B, Style Y or Class A, Style Z.

26) Alarm Dry Contacts: Provide alarm dry contacts (Form C) rated 2 amps at 30 VDC (resistive) and transfer whenever system alarm occurs.

27) Supervisory Dry Contacts: Provide supervisory dry contacts (Form C) rated 2 amps at 30 VDC (resistive) and transfer whenever system supervisory condition occurs.

28) Trouble Dry Contacts: Provide trouble dry contacts (Form C) rated 2 amps at 30 VDC (resistive) and transfer whenever system trouble occurs.

29) Permitted zone types shall be general zone, releasing zone, and special zone. Each output point (control module, panel circuit module) can support a list of up to eight zones including general zone, logic zone, releasing zone, and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.

30) Multiple Agent Releasing Zones: The system shall support up to eight releasing zones to protect against eight independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.

H. Auxiliary Switch Module (ASM-16):

1) Each ASM-16 has 16 programmable push-button switches.

2) Each push-button switch has 3 associated status LEDs (red, yellow, and green), configurable to indicate any combination of functions.

3) Flexible switch configurations to allow flexible set-up of phone, speaker, and auxiliary function circuits.

4) An insertable label to identify function of each switch and LEDs combination.

5) Provide capability to communicate with up to 16 ASM-16 modules locally, up to 3,000 feet (91440 cm) from INCC Command Center.

6) Specialty modules that only perform 1 task such as speaker, phone, or auxiliary shall not be acceptable.

I. Telephone Assembly: Include the following items:

1) Mounting cabinet which occupies 2 module locations on inner door of INCC.

2) Standard phone operating on piezo effect with integral 6-foot cord.

3) Interconnect cable for connection of phone to Command Center.

J. Microphone Assembly: Include the following items:

1) Mounting cabinet which occupies 1 module location on inner door of INCC.

2) Interconnect cable for connection of microphone to INI-VG.

3) 1 noise canceling microphone with push-to-talk button.

K. Addressable Node Expander (ANX):

1) Addressable Node Expander shall provide interconnection between the Fire Alarm Control Panel networks.

2) ANX-MR-FO (Addressable Node Expander Multi-Ring with Fiber Optic connectors) and ANX-MR-UTP (Addressable Node Expander Multi-Ring with Fiber Optic and Twisted Pair connectors) shall expand the E3 Series network from 64 nodes to 122 nodes. ANX-SR (Addressable Node Expander Single Ring) will function in single 64 node systems.

L. Network Repeater Module (RPT-E3):

1) Intelligent Network Interface shall provide interconnection and protection of remote INCC Command Centers and Transponders. Repeater shall regenerate and condition token passing, 625 K baud signal between units. Repeater shall be available in wire, or wire/fiber configurations as determined by field conditions.

M. 2. Interface shall have jumper to allow selection of ground detection of wiring when used in wire mode. Interface shall have integral LEDs to display current status of board.

N. 3. Fiber configurations shall use:

a) Multi-Mode ST-type connectors with a maximum attenuation of 8db with 62.5/125 micron cable.

b) Single-Mode LC-style connector with a maximum attenuation of 30db with 9/125 micron cable.

O. F. Network Graphic Annunciator (NGA): Network able, 1/4 VGA, touch-screen annunciator with the following characteristics:

1) Custom Graphics: Panel shall permit uploading of custom bit-mapped graphic to display screen. Graphic shall display when all systems are normal.

2) Intuitive Functions: In alarm or trouble condition, annunciator shall display only information pertaining to event, including control switches.

a) Trouble Condition: Display shall indicate cause of trouble. Only controls available to operator shall be Acknowledge and Reset functions.
b) Alarm Condition: Display shall indicate cause of alarm. Only controls available to operator shall be Acknowledge, Silence, and Reset functions.

2.4 INTELLIGENT NETWORK TRANSPONDER (INX)

A. System shall be of multiprocessor design to allow maximum flexibility of capabilities and operation. INX shall receive, transmit, and regenerate voice, fire fighter phones, and data over single pair of wire or fiber optic cable.

B. INX shall provide full multi-channel distributed voice messaging, with integrated switching amplification, and SLC and extended phone riser. INX shall communicate with network system in true peer-to-peer fashion operating at 625 K baud over any combination of fiber or wire media. INX shall consist of the following units and components.

C. System Cabinet: System cabinet shall be surface or semi-flush mounted with texture finish and shall consist of 4 parts, back box, back plate, inner door, and outer door. System cabinet houses INI-VG, PM-9 power supply, up to 4 - AM50, microphone, and related circuitry.

D. Intelligent Network Interface Voice Gateway (INI-VG): INI-VG shall be a multi-function board interchangeable in both INCC and INX. Functions of board shall include the following features as a minimum:

1) Network interface operating at 625 K baud configurable with any combination of wire and/or fiber topologies. Interface shall communicate with up to 122 total INCC, INX, and E3 and S3 control panels in peer-to-peer fashion.

2) Fire Fighter Phone Riser: INI-VG shall generate local phone riser for use with AOM-TEL phone modules for connection to fire fighter phone. INI-VG shall mix its local phone riser to network in true Style 7 fashion.

3) Signaling Line Circuit (SLC): INI-VG shall generate local SLC to communicate with and control up to 16 AOM-TEL modules and 32 AOM-2S or AOM-MUX circuits for fire phone interfacing and additional split-speaker circuits.

4) RS-485: Provide capability to communicate with up to 16 ASM-16 modules, when used in INX mode up to 3,000 feet (91440 cm).

5) Advanced Processing: INI-VG shall incorporate latest in digital signaling processing technology with supporting Boolean logic including AND, OR, NOT, TIME DELAY functions.

6) Voice Generation: INI-VG shall incorporate all processing to allow for 16 distinct pre-recorded messages used in priority fashion with message 1 as highest priority. Total length for 1 to 16 messages shall be up to 3 minutes.

E. Power Supply Module (PM-9): PM-9 power supply shall supply all power necessary under normal and emergency conditions. Power supply shall provide capacity to charge up to 55 amp-hour batteries while under full load. Technology used shall be of power-saving switching configuration, eliminating need of stepping transformer.

F. Audio Amplifier (AM-50): Include as a minimum, the following features:

1) 50-watt switching audio amplifier:

   a) AM-50-25 amplifier produces 25VRMS at 50 watts digital audio output.
   b) AM-50-70.7 amplifier produces 70VRMS at 50 watts digital audio output.

2) 2 individually addressable speaker circuits, each with capability of handling part or all of 50-watt supplied power.

3) Power shall be 24 VDC supplied via terminal block from local PM-9 power supply.

4) Ability to select from 1 of 16 pre-programmed messages in INI-VG, and paging from locally or from INCC Command Center.

5) Back-up amplification configurable so 1 AM-50 can perform back-up or 3, or perform 1-to-1 back-up if configured to do so in programming.

6) Status LEDs to indicate normal operation and trouble condition.

2.5 PRINTERS

A. Printers: Automatic type, printing code, time, date, location, category, and condition.

1) Provide hard-copy printout of all changes in status of system and time-stamp such printouts with current time-of-day and date.

2) Standard carriage with 80 characters per line.

3) Use standard pin-feed paper.

4) Enclose in separate enclosure suitable for placement on desktop or table.

5) Communicate with control using interface complying with EIA-232-D.

6) Power: 120 VAC at 60 Hz.

2.6 SUPPLEMENTAL NOTIFICATION APPLIANCE CIRCUIT (HPFF8)

A. Supplemental Notification Appliance Circuit shall be Model HPFF8 offering

B. [up to 8.0 amps (8.0 amps continuous) of regulated 24-volt power. HPFF shall include the following features:

1) Integral Charger: Charge up to 18.0 amp-hour batteries and support 60-hour standby.

2) 2 Input Triggers. Input trigger shall be Notification Appliance Circuit (from fire alarm control panel) or relay.

3) Surface-mount back box.

4) Ability to delay AC fail delay in accordance with applicable NFPA requirements.

5) Power limited circuitry in accordance with applicable UL standards.

6) Operates as sync follower or a sync generator.

2.7 SYSTEM PERIPHERALS - VELOCITI

A. Addressable Devices – General:

1) Provide address-setting means using rotary-decimal switches.

2) Use simple to install and maintain decade-type (numbered 0 to 15) address switches by using standard screwdriver to rotate 2 dials on device to set address. Devices which use binary address set via dipswitch packages, handheld device programmer, or other special tools for setting device address shall not be acceptable.

3) Detectors: Analog and addressable. Connect to fire alarm control panel's Signaling Line Circuits.

4) Addressable Thermal and Smoke Detectors: Provide 2 status LEDs. Both LEDs shall flash under normal conditions, indicating detector is operational and in regular communication with control panel, and both LEDs shall be placed into steady illumination by control panel, indicating alarm condition has been detected. If required, flashing mode operation of detector LEDs can be programmed off via fire control panel program.

5) Fire Alarm Control Panel: Permit detector sensitivity adjustment through field programming of system. Sensitivity can be automatically adjusted by panel on time-of-day basis.

6) Using software in INCC Command Center, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. Detectors shall be listed by UL as meeting calibrated sensitivity test requirements of NFPA 72, Chapter 7.

7) Detectors shall be ceiling-mounted and shall include separate twist-lock base with tamper-proof feature.

8) Following bases and auxiliary functions shall be available:

   a) Standard base with remote LED output.
   b) Sounder base rated at 85 dBA minimum.
   c) Intelligent Addressable Sounder base rated at 75 dBA minimum.
   d) Form-C relay base rated 30 VDC, 2.0 A.
   e) Isolator base.

9) Detectors shall provide test means whereby they will simulate alarm condition and report that condition to control panel. Such test shall be initiated at detector itself by activating magnetic switch or initiated remotely on command from control panel.

10) Detectors shall store internal identifying type code that control panel shall use to identify type of device (ION, PHOTO, THERMAL).

B. Addressable Manual Stations (MS-7AF):

1) Manual Fire Alarm Stations: Non-code, non-break glass type, equipped with key lock so they may be tested without operating handle.

2) Operated Station: Visually apparent, as operated, at a minimum distance of 100 feet (3048 cm) from front or side.

3) Stations shall be designed so after actual activation, they cannot be restored to normal except by key reset.

4) Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on cover. The word FIRE shall appear on front of stations in raised letters, 1.75 inches (44.45 mm) or larger.

5) Addressable manual stations shall, on command from control panel, send data to panel representing state of manual switch and addressable communication module status.

C. Intelligent Thermal Detectors (ATD-RL2F): Intelligent addressable devices rated at 135 degrees Fahrenheit (57.22 degrees Celsius) and have rate-of-rise element rated at 15 degrees Fahrenheit (-9.44 degrees Celsius) per minute. Connect via 2 wires to fire alarm control panel signaling line circuit.

D. Intelligent Photoelectric Smoke Detectors (ASD-PL2F): Use photoelectric (light-scattering) principal to measure smoke density and shall, on command from control panel, send data to panel representing analog level of smoke density.

E. Intelligent Ionization Smoke Detectors (ASD-IL2F): Use dual-chamber ionization principal to measure products of combustion and shall, on command from control panel, send data to panel representing analog level of products of combustion.

F. Intelligent Multi-Criteria Acclimating Detectors (MCS-ACCLIMATE2F):

1) Addressable device designed to monitor a minimum of photoelectric and thermal technologies in single-sensing device. Include ability to adapt to its environment by utilizing built-in microprocessor to determine its environment and choose appropriate sensing settings. Allow wide sensitivity window, with no less than 1 to 4 percent per foot obscuration. Utilize advanced electronics that react to slow smoldering fires and thermal properties within single sensing device.

2) Microprocessor: Capable of selecting appropriate sensitivity levels based on environment type it is in, such as office, manufacturing, or kitchen, and then have ability to automatically change setting as environment changes, as when walls are moved or as occupancy changes.

3) Intelligent multi-criteria detection device shall include ability to combine signal of thermal sensor with signal of photoelectric signal to react hastily in event of fire situation. Include inherent ability to distinguish between fire condition and false alarm condition by examining characteristics of thermal and smoke sensing chambers and comparing them to database of actual fire and deceptive phenomena.

G. Intelligent 4 Element Multi-Criteria Detectors (MCS-4-WARN):

1) The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical carbon monoxide (CO) sensor, a daylight-filtered infrared sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.

2) The intelligent multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in an effort to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The product design shall be capable of selecting the appropriate sensitivity levels based on the environment type chosen by user in which it is installed (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes.

3) The detector shall indicate CO trouble conditions including 6 months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.

4) The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by

activating a switch) or initiated remotely on command from the control panel. There are three test methods: functional magnet, smoke entry aerosol, or direct heat method.

H. Intelligent Fire/Carbon Monoxide Detectors (MCS-COF):

1) The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical CO sensor, a daylight-filtered infrared (IR) sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.

2) The advanced multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in order to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The detector shall be capable of selecting the appropriate sensitivity levels based on the environment type (office, manufacturing, kitchen, etc.) in which it is installed, and then have the ability to automatically change the setting as the environment changes.

3) The CO detector component shall be capable of a functional gas test using a canned test agent to test the functionality of the CO sensing cell.

4) The detector shall indicate CO trouble conditions, including six months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.

I. Intelligent Laser Detectors (ASD-LS): Sensor device designed to use laser diode similar to the way photoelectric sensor uses LEDs inside of sensing chamber. Detector design shall allow wide sensitivity window, with no less than 0.2 to 4 percent per foot obscuration. Detector shall be used as indicated in special application clean-room-type environments only.

J. Intelligent Aspiration Smoke Detector (AAD-8100):

1) The AAD-8100 shall offer Very Early Warning Smoke Detection, Early Warning Smoke Detection and Standard Smoke Detection settings.

2) It shall be tested and approved for coverage up to 8,000 sq. ft.

3) The ASD shall have dual source (blue LED and infra-red laser) optical smoke detection for a wide range of fire detection with enhanced immunity to nuisance particulates.

4) The ASD shall operate in air flows from 0-4000 ft/min (0-1333.11 yard (1,219 meter)/min).

5) PipeIQ software shall provide pipe design, FAAST system configuration, and FAAST system monitoring in a single software program.

6) The ASD shall allow 5 programmable alarm levels with time delays, including Alert, Action 1, Action 2, Fire 1, and Fire 2.

K. Intelligent Duct Smoke Detector Base (DNR, DNRW):

1) In-Duct Smoke Detector Housing: Use ASD-PL2F intelligent photoelectric detector, ASD-PL2FR intelligent remote test photoelectric detector or ASD-IL2F intelligent ionization detector, which provides continuous analog monitoring and alarm verification from panel.

2) When sufficient smoke is sensed, alarm signal is initiated, and appropriate action taken to shut down or change over air handling systems to help prevent rapid distribution of toxic smoke and fire gases throughout areas served by duct system.

3) Duct Smoke Detectors Mounted Above Ceiling or Otherwise Obstructed from Normal View: Provide with remote alarm indicator.

4) Each Detector: Install in either supply side or return side duct in accordance with local mechanical code.

L. Addressable Dry Contact Monitor Modules (AMM-2F):

1) Provide to connect 1 supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to 1 of the fire alarm control panel SLCs.

2) Mount in standard deep electrical box.

3) IDC Zone: Suitable for Style B operation.

M. Addressable Dry Contact Monitor Modules (AMM-4F):

1) Provide to connect 1 supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to 1 of the fire alarm control panel SLCs.

2) Mount in 4-inch (102-mm) square, 2-1/8-inch (54-mm) deep electrical box.

3) IDC Zone: Suitable for Style D or Style B operation.

4) LEDs: Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

N. Addressable Dry Contact Monitor Modules (AMM-2IF):

1) Provide to connect 2 supervised IDC zones of conventional alarm initiating devices (any N.O. dry contact device) to 1 of the fire alarm control panel SLCs.

2) Mount in 4-inch (101.6-mm) square, 2-1/8-inch (54-mm) deep electrical box.

3) IDC Zones: Suitable for Style B operation.

4) LEDs: Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

O. Addressable Two Input and Two Output Modules (AMM-2RIF):

1) Provide two isolated sets of Form-C contacts, which operate as a single pole double throw switch. The module shall allow the control panel to switch these contacts on command. The module shall not provide supervision for the notification appliance circuit (NAC). Module shall have both normally open and normally closed connections available for field wiring. Two input modules shall connect two supervised initiating device circuit (IDC) or zone of conventional alarm initiating devices (any normally open dry contact device) to the fire alarm control panel signaling line circuit (SLC) Loop.

2) Mount in 4-inch (101.6-mm) square, 2-1/8-inch (54-mm) deep electrical box.

3) IDC Zones: Suitable for Style B operation.

4) LEDs: Four LEDs that are controlled by the panel to indicate status of each input and output. Coded signals, transmitted from the panel, can cause the LED to blink, latch on, or latch off. Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

P. Addressable Dry Contact Monitor Modules (MMI-10F):

1) Provide to connect 10 supervised Style B IDC zones or 5 supervised Style D IDC zones of conventional alarm initiating devices (any N.O. dry contact device) to 1 of the fire alarm control panel SLCs.

2) Mount in factory-supplied MBB-2 or MBB-6 enclosure.

3) LEDs: Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

Q. Addressable Releasing Modules (TC810S1000)

1) Provide supervision and control operation releasing agent solenoids.

2) The module shall operate on a redundant protocol for added protection

3) The module shale be configurable for Style Z or Style Y (Class A or Class B) and support one 24 volt or two 12 volt solenoids.

R. Addressable 2-Wire Detector Monitor Modules (AMM-4SF):

1) Provided to connect 1 supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).

2) Mount in 4-inch (101.6-mm) square, 2-1/8-inch (54-mm) deep electrical box or to optional surface-mounted back box.

3) IDC Zone: Wired for Class A or B (Style D or Style B) operation.

4) LEDs: Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

S. 2-Wire Detector Monitor Modules (MMI-6SF):

1) Provided to connect 6 supervised Class B IDC zones of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).

2) Mount in factory-supplied MBB-2 or MBB-6 enclosure.

3) LEDs: Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

T. Addressable Control Modules (AOM-2SF):

1) Provide to supervise and control operation of 1 conventional NAC of compatible, 24-VDC powered, polarized audio/visual notification appliances or UL-listed polarized relays for fan shutdown and other auxiliary control functions.

2) Mount in standard 4-inch (101.6-mm) square, 2-1/8-inch (54-mm) deep electrical box or to surface-mounted back box.

3) Control Module NAC: Wire for Style Z or Style Y (Class A/B) with up to 1 amp of inductive signal or 2 amps of resistive signal operation. Relay coil shall be magnetically latched to reduce wiring connection requirements and to ensure 100 percent of all auxiliary relay or NACs shall be energized at same time on same pair of wires.

4) Audio/Visual Power: Provide by separate supervised power circuit from main fire alarm control panel or from supervised, UL-listed remote power supply.

U. Addressable Control Modules (MMO-6SF):

1) Provide to supervise and control operation of 1 conventional NAC of compatible, 24-VDC powered, polarized audio/visual notification appliances or UL-listed polarized relays for fan shutdown and other auxiliary control functions.

2) Mount in factory-supplied MBB-2 or MBB-6 enclosure.

3) LEDs: Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

4) Control module NAC: Wire for Style Z or Style Y (Class A/B) with up to 1 amp of inductive signal or 2 amps of resistive signal operation. Relay coil shall be magnetically latched to reduce wiring connection requirements and to ensure 100 percent of all auxiliary relay or NACs shall be energized at same time on same pair of wires.

5) Audio/Visual Power: Provide by separate supervised power circuit from main fire alarm control panel or from supervised, UL-listed remote power supply.

V. Addressable Relay Modules (AOM-2RF):

1) Provide two isolated sets of Form-C contacts, which operate as a double pole double throw switch. The module shall allow the control panel to switch these contacts on command. The module shall not provide supervision for the notification appliance circuit (NAC). Module shall have both normally open and normally closed connections available for field wiring.

2) Available for HVAC control and other building functions. Relay shall have 2 Form C sets of contacts that operate in tandem and are rated for a minimum of 2.0 amps resistive or 1.0 amps inductive. Relay coil shall be magnetically latched to reduce wiring connection requirements and to ensure 100 percent of all auxiliary relay or NACs shall be energized at same time on same pair of wires.

3) Mount in standard 4-inch (101.6-mm) square, 2-1/8-inch (54-mm) deep electrical box or to surface-mounted back box.

4) LEDs: Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

W. Addressable Relay Modules (MMO-6RF):

1) Provide six isolated sets of Form-C contacts, which operate as a double-pole double-throw switch. The module shall allow the control panel to switch these contacts on command. The module shall not provide supervision for the notification appliance circuit (NAC). Module shall have both normally open and normally closed connections available for field wiring.

2) Available for HVAC control and other building functions. Relay shall be Form C and rated for a minimum of 2.0 amps resistive or 1.0 amps inductive. Relay coil shall be magnetically latched to

reduce wiring connection requirements and to ensure 100 percent of all auxiliary relay or NACs shall be energized at same time on same pair of wires.

3) Mount in factory-supplied MBB-2 or MBB-6 enclosure.

4) LEDs: Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

X. Isolator Modules (M500X):

1) Provide to automatically isolate wire-to-wire short circuits on SLC Class A or Class B branch. Isolator module shall limit number of modules or detectors that may be rendered inoperative by short-circuit fault on SLC loop segment or branch. At least 1 isolator module shall be provided for each floor or protected zone of building. No more than 25 devices shall be connected to 1 isolator module.

2) If wire-to-wire short occurs, isolator module shall automatically open-circuit (disconnect) SLC. When short-circuit condition is corrected, isolator module shall automatically reconnect isolated section.

3) Does not require address-setting, and its operations shall be totally automatic. Not necessary to replace or reset isolator module after normal operation.

4) Mount in standard 4-inch (101.6-mm) deep electrical box or in surface-mounted back box.

5) Single LED: Flash to indicate isolator is operational and illuminate steadily to indicate short-circuit condition has been detected and isolated.

Y. Conventional Heat Detectors:

1) Combination rate-of-rise and fixed temperature rated at 135 degrees Fahrenheit (57.22 degrees Celsius) for areas where ambient temperatures does not exceed 100 degrees Fahrenheit (37.78 degrees Celsius), and 200 degrees Fahrenheit (93.33 degrees Celsius) for areas where temperature does not exceed 150 degrees Fahrenheit (65.56 degrees Celsius).

2) Low profile, ceiling-mount type with positive indication of activation.

3) Rate-of-Rise Element: Air chamber, flexible metal diaphragm, and factory-calibrated, moisture-proof, trouble-free vent, and operate when rate of temperature rise exceeds 15 degrees Fahrenheit (-9.44 degrees Celsius) per minute.

4) Fixed-Temperature Element: Fusible-alloy retainer and actuator shaft.

5) Smooth Ceiling Rating: 2,500 sq feet (2.69107 sq cm).

Z. Conventional Photoelectric Area Smoke Detectors:

1) 24-VDC, 2-wire, ceiling-mounted, light-scattering type using LEDs light source.

2) Each Detector: Remote LEDs output and built-in test switch.

3) Provide on twist-lock base.

4) Perform calibrated sensitivity and performance test on detector without need for generation of smoke. Test method shall test all detector circuits.

5) Visual Indication of Alarm: Provide by dual-latching LEDs on detector, seen from ground level over 360 degrees. LEDs shall flash every 10 seconds, indicating power is applied to detector.

6) Detector shall not go into alarm or trouble when exposed to air velocities of up to 3,000 feet (91440 cm) per minute.

7) Detector Screen and Cover Assembly: Easily removable for field cleaning of detector chamber.

8) Field-Wire Connections: Made to base through use of clamping plate and screw.

AA. Conventional Ionization-Type Smoke Detectors:

1) 2-wire, 24-VDC type using dual uni-polar chamber.

2) Each Detector: Remote LEDs output and built-in test switch.

3) Provide on twist-lock base.

4) Perform calibration sensitivity and performance test on detector without need for generation of smoke.

5) Visual Indication of Alarm: Provide by dual-latching LEDs over 360 degrees, on detector, seen from ground level. LEDs shall flash every 10 seconds, indicating power is applied to detector.

6) Detector shall not alarm or trouble when exposed to air velocities of up to 1,200 feet (36576 cm) per minute.

7) Detector Screen and Cover Assembly: Easily removable for field cleaning of detector chamber.

8) Field-Wire Connections: Made to base through use of clamping plate and screw.

BB. AB. Addressable Projected Beam Detectors (ABD-2F, ABD-RT2F):

1) Single-ended, reflective design.

2) Six user-selectable sensitivity levels.

3) Operates in range from 16 feet (487.68 cm) to 328 feet (9997.44 cm).

4) Temperature Range of Device: Minus 22 degrees Fahrenheit (-5.56 degrees Celsius) to 131 degrees Fahrenheit (55 degrees Celsius).

5) Beam Detector: Automatic gain control to compensate for gradual signal deterioration from dirt accumulation on lenses.

6) UL Listed.

7) Ability to be tested using calibrated test filters or magnet-activated remote test station.

8) Entire Installed Assembly: Tamper proof and arranged to cause switch operation if housing cover is removed or if unit is removed from mounting.

9) Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

2.8 .1 SYSTEM PERIPHERALS – APOLLO XP95

A. ILI95-MB-E3 and ILI95-S-E3 Addressable Devices – General:

1) Provide address-setting means using card inserts which are built into the base or module.

2) Use simple to install and maintain binary-type (numbered 1 to 64) address switches by using breaking the tabs to set address.

3) Detectors: Analog and addressable. Connect to fire alarm control panel's Signaling Line Circuits.

4) Addressable Thermal and Smoke Detectors: Provide 1 status LED. The LED shall flash under normal conditions, indicating detector is operational and in regular communication with control panel, and the LED shall be placed into steady illumination by control panel, indicating alarm condition has been detected. If required, flashing mode operation of detector LED can be programmed off via fire control panel program.

5) Fire Alarm Control Panel: Permit detector sensitivity adjustment through field programming of system. Sensitivity can be automatically adjusted by panel on time-of-day basis.

6) Using software, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. Detectors shall be listed by UL as meeting calibrated sensitivity test requirements of NFPA 72, Chapter 7.

7) Detectors shall be ceiling-mounted and shall include separate twist-lock base with tamper-proof feature.

8) Following bases and auxiliary functions shall be available:

   a) Standard base with remote LED output.
   b) Sounder base rated at 85 dBA minimum.
   c) Form-C relay base rated 30 VDC, 2.0 A.
   d) Isolator base.

9) Detectors shall provide test means whereby they will simulate alarm condition and report that condition to control panel. Such test shall be initiated at detector itself by canned smoke or initiated remotely on command from control panel.

10) Detectors shall store internal identifying type code that control panel shall use to identify type of device (ION, PHOTO, THERMAL).

B. Addressable Manual Stations (MS95-L):

1) Manual Fire Alarm Stations: Non-code, non-break glass type, equipped with key lock so they may be tested without operating handle.

2) Operated Station: Visually apparent, as operated, at a minimum distance of 100 feet (3048 cm) from front or side.

3) Stations shall be designed so after actual activation, they cannot be restored to normal except by key reset.

4) Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on cover. The word FIRE shall appear on front of stations in raised letters, 1.75 inches (44.45 mm) or larger.

5) Addressable manual stations shall, on command from control panel, send data to panel representing state of manual switch and addressable communication module status.

C. Intelligent Thermal Detectors (XP95-T): Intelligent addressable devices rated at 194 degrees Fahrenheit (90 degrees Celsius) and have rate-of-rise element rated at 15 degrees Fahrenheit (-9.44 degrees Celsius) per minute. Connect via 2 wires to fire alarm control panel signaling line circuit.

D. Intelligent Photoelectric Smoke Detectors (XP95-P): Use photoelectric (light-scattering) principal to measure smoke density and shall, on command from control panel, send data to panel representing analog level of smoke density.

E. Intelligent Ionization Smoke Detectors (XP95-I): Use dual-chamber ionization principal to measure products of combustion and shall, on command from control panel, send data to panel representing analog level of products of combustion.

F. Intelligent Multi-Criteria Detectors (XP95-M):

1) Addressable device designed to monitor a minimum of photoelectric and thermal technologies in single-sensing device. Include ability to adapt to its environment by utilizing built-in microprocessor to determine its environment and choose appropriate sensing settings. Allow wide sensitivity window, with no less than 1 to 4 percent per foot obscuration. Utilize advanced electronics that react to slow smoldering fires and thermal properties within single sensing device.

2) Microprocessor: Capable of selecting appropriate sensitivity levels based on environment type it is in, such as office, manufacturing, or kitchen, and then have ability to automatically change setting as environment changes, as when walls are moved or as occupancy changes.

3) Intelligent multi-criteria detection device shall include ability to combine signal of thermal sensor with signal of photoelectric signal to react hastily in event of fire situation. Include inherent ability to distinguish between fire condition and false alarm condition by examining characteristics of thermal and smoke sensing chambers and comparing them to database of actual fire and deceptive phenomena.

G. Intelligent Duct Smoke Detectors (SL-DAA-P/SL-DAA-N):

1) In-Duct Smoke Detector Housing: Use on-board intelligent photoelectric or ionization detector, which provides continuous analog monitoring and alarm verification from panel.

2) When sufficient smoke is sensed, alarm signal is initiated, and appropriate action taken to shut down or change over air handling systems to help prevent rapid distribution of toxic smoke and fire gases throughout areas served by duct system.

3) Duct Smoke Detectors Mounted Above Ceiling or Otherwise Obstructed from Normal View: Provide with remote alarm indicator.

4) Each Detector: Install in either supply side or return side duct in accordance with local mechanical code.

H. Addressable Dry Contact Monitor Modules (PID-95/PID-95P):

1) Provide to connect 1 supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to 1 of the fire alarm control panel SLCs.

2) Mount in standard deep electrical box or plastic plate.

3) IDC Zone: Suitable for Style B operation.

I. Addressable Dry Contact Monitor Modules (CZI-95):

1) Provide to connect 1 supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device) to 1 of the fire alarm control panel SLCs.

2) Mount in 4-inch (102-mm) square, 2-1/8-inch (54-mm) deep electrical box.

3) IDC Zone: Suitable for Style B, C, D or Style E operation.

4) LEDs: Flash under normal conditions, indicating monitor module is operational and in regular communication with control panel.

J. Addressable Control Modules (SCE-95):

1) Provide to supervise and control operation of 1 conventional NAC of compatible, 24-VDC powered, polarized audio/visual notification appliances or UL-listed polarized relays for fan shutdown and other auxiliary control functions.

2) Mount in standard 4-inch (101.6-mm) square, 2-1/8-inch (54-mm) deep electrical box or to surface-mounted back box.

3) Control Module NAC: Wire for Style Z or Style Y (Class A/B) with 2 amps of resistive signal operation. Relay coil shall be magnetically latched to reduce wiring connection requirements and to ensure 100 percent of all auxiliary relay or NACs shall be energized at same time on same pair of wires.

4) Audio/Visual Power: Provide by separate supervised power circuit from main fire alarm control panel or from supervised, UL-listed remote power supply.

K. Addressable Relay Modules (RCE-95):

1) Available for HVAC control and other building functions. Relay shall have 1 Form C set of contacts and are rated for a minimum of 2.0 amps resistive. Relay coil shall be magnetically latched to reduce wiring connection requirements and to ensure 100 percent of all auxiliary relay or NACs shall be energized at same time on same pair of wires. The device shall provide positive feedback of the controlled equipment’s status annunciating upon activation.

2) Mount in standard 4-inch (101.6-mm) square, 2-1/8-inch (54-mm) deep electrical box or to surface-mounted back box.

L. Addressable Building Control Modules (BCE-95):

1) Available for building functions that require three position (On/Off/Auto) control capability. Relay shall have 1 Form C set of contacts and are rated for a minimum of 2.0 amps resistive. Relay coil shall be magnetically latched to reduce wiring connection requirements and to ensure 100 percent of all auxiliary relay or NACs shall be energized at same time on same pair of wires. The device shall provide positive feedback of the controlled equipment’s status annunciating upon activation.

2) Mount in standard 4-inch (101.6-mm) square, 2-1/8-inch (54-mm) deep electrical box or to surface-mounted back box.

M. Isolator Modules (XP95-LI):

1) Provide to automatically isolate wire-to-wire short circuits on SLC Class A or Class B branch. Isolator module shall limit number of modules or detectors that may be rendered inoperative by short-circuit fault on SLC loop segment or branch. At least 1 isolator module shall be provided

for each floor or protected zone of building. No more than 20 devices shall be connected to 1 isolator module.

2) If wire-to-wire short occurs, isolator module shall automatically open-circuit (disconnect) SLC. When short-circuit condition is corrected, isolator module shall automatically reconnect isolated section.

3) Does not require address-setting, and its operations shall be totally automatic. Not necessary to replace or reset isolator module after normal operation.

4) Mount in unique base, eliminating addressable sensors from being installed incorrectly.

5) Single LED: Flash to indicate isolator is operational and illuminate steadily to indicate short-circuit condition has been detected and isolated.

N. Conventional Heat Detectors:

1) Combination rate-of-rise and fixed temperature rated at 135 degrees Fahrenheit (57.22 degrees Celsius) for areas where ambient temperatures does not exceed 100 degrees Fahrenheit (37.78 degrees Celsius), and 200 degrees Fahrenheit (93.33 degrees Celsius) for areas where temperature does not exceed 150 degrees Fahrenheit (65.56 degrees Celsius).

2) Low profile, ceiling-mount type with positive indication of activation.

3) Rate-of-Rise Element: Air chamber, flexible metal diaphragm, and factory-calibrated, moisture-proof, trouble-free vent, and operate when rate of temperature rise exceeds 15 degrees Fahrenheit (-9.44 degrees Celsius) per minute.

4) Fixed-Temperature Element: Fusible-alloy retainer and actuator shaft.

5) Smooth Ceiling Rating: 2,500 sq feet (2.69107 sq cm).

O. Conventional Photoelectric Area Smoke Detectors:

1) 24-VDC, 2-wire, ceiling-mounted, light-scattering type using LEDs light source.

2) Each Detector: Remote LEDs output and built-in test switch.

3) Provide on twist-lock base.

4) Perform calibrated sensitivity and performance test on detector without need for generation of smoke. Test method shall test all detector circuits.

5) Visual Indication of Alarm: Provide by dual-latching LEDs on detector, seen from ground level over 360 degrees. LEDs shall flash every 10 seconds, indicating power is applied to detector.

6) Detector shall not go into alarm or trouble when exposed to air velocities of up to 3,000 feet (91440 cm) per minute.

7) Detector Screen and Cover Assembly: Easily removable for field cleaning of detector chamber.

8) Field-Wire Connections: Made to base through use of clamping plate and screw.

P. Conventional Ionization-Type Smoke Detectors:

1) 2-wire, 24-VDC type using dual uni-polar chamber.

2) Each Detector: Remote LEDs output and built-in test switch.

3) Provide on twist-lock base.

4) Perform calibration sensitivity and performance test on detector without need for generation of smoke.

5) Visual Indication of Alarm: Provide by dual-latching LEDs over 360 degrees, on detector, seen from ground level. LEDs shall flash every 10 seconds, indicating power is applied to detector.

6) Detector shall not alarm or trouble when exposed to air velocities of up to 1,200 feet (36576 cm) per minute.

7) Detector Screen and Cover Assembly: Easily removable for field cleaning of detector chamber.

8) Field-Wire Connections: Made to base through use of clamping plate and screw.

Q. Sprinkler Waterflow Switches (provided and installed by the sprinkler contractor):

1) Integral, mechanical, non-coded, non-accumulative retard type.

2) Alarm transmission delay time conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30 to 45 seconds.

3) Single manufacturer and series.

4) Where possible, locate waterflow switches a minimum of 1 foot (30.48 cm) from fitting which changes direction of flow and a minimum of 3 feet (91.44 cm) from valve.

5) Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor.

R. Sprinkler and Standpipe Valve Supervisory Switches (provided and installed by the sprinkler contractor):

1) Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with supervisory switch. Standpipe hose valves, test valves, and drain valves shall not be equipped with supervisory switches.

2) PIV (Post Indicator Valve) or Main Gate Valves: Equip with supervisory switch.

3) Mount not to interfere with normal operation of valve and adjust to operate within 2 revolutions toward closed position of valve control, or when stem has moved no more than one-fifth of distance from normal position.

4) Contain in weatherproof aluminum housing, which shall provide 3/4-inch (19-mm) conduit entrance and incorporate necessary facilities for attachment to valves.

5) Switch Housing Finish: Red baked enamel.

6) Entire Installed Assembly: Tamper proof and arranged to cause switch operation if housing cover is removed or if unit is removed from mounting.

7) Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

2.9 SYSTEM PERIPHERALS – E3 SERIES

A. Graphic Annunciator (Uses ANU-48 Serial Driver Board):

1) Communicate to fire alarm control panel via EIA-485 (multi-drop) 2-wire communications loop. Up to 16 annunciator drivers, each configured up to 48 points, shall be connected per SLP panel locally, or up to 3,000 feet (91440 cm) from the Control Panel.

2) ANU-48: Provide interface to approved UL-listed graphic-style LED annunciator and provide each of the features specified.

B. Auxiliary Switch Module (ASM-16):

1) Each ASM-16 has 16 programmable push-button switches.

2) Each push-button switch has 3 associated status LEDs (red, yellow, and green), configurable to indicate any combination of functions.

3) Flexible switch configurations to allow auxiliary functions.

4) An insertable label to identify function of each switch and LEDs combination.

5) Provide capability to communicate with up to 16 ASM-16 modules locally, or up to 3,000

C. feet from the Control Panel.

D. LCD Display Annunciator:

1) Furnish and install as indicated on the Drawings a remote serial annunciator, Model LCD-7100. Annunciator shall provide 80-character display, which shall duplicate all information on basic system display, including any network nodes its host panel is annunciating, with exception of menus. Contain the following function keys:

a) Alarm Acknowledge.
b) Trouble Acknowledge.
c) Signal Silence.
d) System Reset/Lamp Test.
e) System Drill Test.

2) Key Lock: Enable switches only when placed in “ON” position, with exception of Trouble Acknowledge, which is used to silence local trouble audible sounder. Annunciator shall contain the following LEDs:

a) Alarm.
b) Supervisory.
c) System Trouble.
d) Power Fault.
e) System Silenced.

3) Mount on standard 3-gang surface or flush electrical box.

4) Each ILI-MB-E3/ILI95-MB-E3: Accommodate up to 5 remote LCD-7100 annunciators which shall be located up to 3,000 feet (91440 cm) from control panel.

E. NGA Network Graphic Annunciator

F. Main Menu

a) Configure allows Auto-configuration of ILI-MB-E3/ILI-S-E3/ and ILI95-MB-E3/ILI95-S-E3 and NGA or ANX.
b) Walk/Drill enables Walk Test and Fire Drill function.
c) I/O Allows enable/disable input and output devices.
d) Clock system real-time clock.
e) View system configuration information
f) NGA log displays, stores, prints and clears the 4100 event history log.
g) Service provides Network Query functions.
h) h. (More spec items – Text messaging, custom logo, custom screensaver, max amount of text on screen at one time)

G. Portable Emergency Telephone Handset Jacks:

1) Flush mount on stainless steel plates as indicated on the Drawings.

2) Approved for emergency telephone system application.

3) Insertion of remote handset plug into jack shall send signal to fire INCC Command Center which shall audibly and visually indicate on-line condition and sound a ring indication in handset.

4) 2-Way Emergency Telephone System: Support a minimum of five (5) handsets on line without degradation of signal

5) Cabinet: Provide in fire control room to house 10 portable handsets.

H. Fixed Emergency Telephone Handsets:

1) Telephone Cabinets:

a) Paint red and clearly label emergency telephone.
b) Locate as indicated on the Drawings.
c) Key same as INCC Command Center, INX Transponders, and manual stations.

2) Handset Cradle: Cam-operated microswitch connection such that lifting handset off cradle sends signal to fire INCC Command Center which shall audibly and visually indicate on-line (off-hook) condition. Open blade finder contacts shall not be acceptable.

3) 2-Way Emergency Telephone System: Support a maximum of five 5 handsets on line (off hook) without degradation of signal.

I. Speakers:

1) Operate on 25 VRMS or 70.7 VRMS with field-selectable output taps from 0.5 to 2.0 watts.

2) Speakers in Corridors and Public Spaces: Produce nominal sound output of 84 dBA at 10 feet (304.8 cm).

3) Frequency Response: Minimum of 400 Hz to 4,000 Hz.

4) Back of Each Speaker: Sealed to protect speaker cone from damage and dust.

J. Strobes:

1) Compliance: ADA and UL 1971.

2) Maximum Pulse Duration: 0.2 second.

3) Strobe Intensity: UL 1971.

4) Flash Rate: UL 1971.

5) Strobe Candela Rating: Determine by positioning selector switch on back of device.

K. I Speaker/Strobes:

1) Operate on 25 VRMS or with field-selectable output taps from 0.5 to 2.0 watt

2) Speakers in Corridors and Public Spaces: Produce nominal sound output of 84 dBA at 10 feet (304.8 cm).

3) Frequency Response: Minimum of 400 Hz to 4,000 Hz.

4) Back of Each Speaker: Sealed to protect speaker cone from damage and dust.

5) Audibility: NFPA 72.

6) Maximum Pulse Duration: 0.2 second.

7) Strobe Intensity: UL 1971.

8) Flash Rate: UL 1971.

9) Strobe Candela Rating: Determine by positioning selector switch on back of device.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive fire alarm system.

1) Notify Architect of conditions that would adversely affect installation or subsequent use.

2) Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

A. Install fire alarm system in accordance with NFPA 72, NFPA 70, state and local codes, manufacturer's instructions, and as indicated on the Drawings.

B. Conceal conduit, junction boxes, and conduit supports and hangers in finished areas. Conceal or expose conduit, junction boxes, and conduit supports and hangers in unfinished areas.

C. Do not install smoke detectors before system programming and test period. If construction is ongoing during this period, take measures to protect smoke detectors from contamination and physical damage.

D. Flush-mount fire detection and alarm system devices, control panels, and remote annunciators in finished areas. Flush-mount or surface-mount fire detection and alarm system devices, control panels, and remote annunciators in unfinished areas.

E. Ensure manual stations are suitable for surface mounting or semi-flush mounting as indicated on the Drawings. Install not less than 42 inches (1066.8 mm), nor more than 48 inches (1219.2 mm), above finished floor measured to operating handle.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide service of competent, factory-trained technician authorized by manufacturer to technically supervise and participate during pre-testing and acceptance testing of system.

B. Testing:

1) Conduct complete visual inspection of control panel connections and test wiring for short circuits, ground faults, continuity, and insulation before energizing cables and wires.

2) Close each sprinkler system control valve and verify proper supervisory alarm at INCC Command Center.

3) Verify activation of flow switches.

4) Open initiating device circuits and verify that trouble signal actuates.

5) Open signaling line circuits and verify that trouble signal actuates.

6) Open and short notification appliance circuits and verify that trouble signal actuates.

7) Ground initiating device circuits and verify response of trouble signals.

8) Ground signaling line circuits and verify response of trouble signals.

9) Ground notification appliance circuits and verify response of trouble signals.

10) Check alert tone and prerecorded voice message to alarm notification devices.

11) Check installation, supervision, and operation of intelligent smoke detectors.

12) Introduce on system each of the alarm conditions that system is required to detect. Verify proper receipt and proper processing of signal at INCC Command Center and correct activation of control points.

13) Consult manufacturer's manual to determine proper testing procedures when system is equipped with optional features. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality, and similar.

C. Acceptance Testing:

1) Before installation shall be considered completed and acceptable by AHJ, a complete test using as a minimum, the following scenarios shall be performed and witnessed by representative approved by Engineer. Monitoring company and/or fire department shall be notified before final test in accordance with local requirements.

2) Contractor's job foreman, in presence of representative of manufacturer, representative of Owner, and fire department shall operate every installed device to verify proper operation and correct annunciation at control panel.

3) Open signaling line circuits and notification appliance circuits in at least 2 locations to verify presence of supervision.

4) Completely disconnect INCC Command Center from rest of network, including Voice INCC Command Center. Activate initiating device from transponder. All speaker circuits activated

from each transponder shall transmit the correct evacuation or alert message. These messages shall be same messages transmitted with INCC Command Center activated. Default tones or messages shall not be acceptable.

5) Completely disconnect INCC Command Center from rest of network. Activate initiating device. All control outputs supported by transponder SLC circuits shall operate under project programming mode. Default or degrade mode programming shall not be acceptable.

6) Fire fighter phone riser shall be directly shorted between INCC Command Center and first transponder, followed by test of fire phones between INCC Command Center and farthest transponder. Phones shall operate in normal fashion.

7) All audio risers shall be directly shorted between INCC Command Center and first audio transponder, followed by activation of alarm initiating device. Correct pre-recorded messages shall transmit from all speakers, including evacuation and alert channels. Default or degrade messages shall not be acceptable.

8) When testing has been completed to satisfaction of both Contractor's job foreman and representatives of manufacturer and Owner, a notarized letter co-signed by each attesting to satisfactory completion of said testing shall be forwarded to Owner and fire department.

9) Leave fire alarm system in proper working order and, without additional expense to Owner, replace defective materials and equipment provided within 1 year (365 days) from date of final acceptance by the owner.

3.4 DEMONSTRATION

A. Provide instruction as required for operating fire alarm system.

B. Provide hands-on demonstrations of operation of fire alarm system components and functions.

END OF SECTION

END OF SECTION

SECTION 31 1000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Clear and grub the site as shown on the Drawings and specified in this Section.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 31 2000: Earthwork.
3. For additional information, refer to Geotechnical Engineering Investigation With Geologic Hazards Evaluation prepared by Salem Engineering Group, dated September 29, 2020, and updates thereof.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials, not specifically described but required for proper completion of the work of this Section, 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 PROTECTION

A. Protect existing utilities indicated or made known.

B. Protect trees and shrubs, where indicated to remain, by providing a fence around the tree or shrub of sufficient distance away and of sufficient height so trees and shrubs will not be damaged in any way as part of this Work.

C. Protection of persons and property:
1. Barricade open depressions and holes occurring as part of this Work, and post warning lights on property adjacent to or with public access.
2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by operations under this Section.
4. Barricade and post or backfill all open trenches outside of fenced areas when not on job site.

D. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

E. Maintain access to the site at all times.

3.3 CLEARING

A. Prior to earthwork operations, strip entire site of vegetation, organic topsoil. Clear surface and subsurface obstructions and miscellaneous debris from the proposed building, exterior concrete, and paving areas.
   1. Stripping: Approximately 2”-4" deep. The actual depth of stripping will be reviewed by the responsible inspecting Geotechnical Engineer.
   2. Deeper stripping may be required in localized areas. The stripped vegetation will not be suitable for use as Engineered Fill or within 5 feet of building pads.

B. Clear organic matter, vegetation, rubbish, debris, and loose soil deposits from the banks and bottoms of the irrigation canal and ditch.

3.4 CONSERVATION OF TOPSOIL

A. Stockpile the stripped organic topsoil in an area clear of new construction in order to provide topsoil for areas shown on the Drawings to be turfed or planted, and to fill planters, without contamination with subsoils.

B. Maintain the stockpile in a manner which will not obstruct the natural flow of drainage.
   1. Maintain stockpile free from debris and trash.
   2. Keep the topsoil damp to prevent dust and drying out.

3.5 DISPOSAL

A. Remove brush, grass, roots, trash, and other material from clearing operations. Dispose of away from the site in a legal manner.

B. Do not store or permit debris to accumulate on the job site.

C. Dispose of any excess topsoil after fine grading has been accepted by the Architect.

D. Do not burn debris at the site.

E. Excavated Soils and Land Clearing Debris: 100% of trees, stumps, rocks, and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled, except for reuse, either on site or off site of vegetation or soil contaminated by disease or pest infestation.

   1. Refer to Section 01 7425.

3.6 UTILITIES

A. Coordinate with utility companies and agencies as required. See Section 02 3100.

B. Where utility cutting, capping, or plugging is required, perform such work in accordance with requirements of the utility company or governmental agency having jurisdiction.

END OF SECTION 31 1000

SECTION 31 2000 - EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. In accordance with pertinent provisions of this Section, trench, excavate, fill, backfill, compact, and grade the site to the elevations shown on the Drawings and as needed to meet the requirements of the construction shown in the Contract Documents.

B. The work of this Section includes, but is not limited to, the following:
1. Preparation of sub-grade for buildings, walks, pavements, and landscaping.
2. Site grading, cut, fill, and finish, off-haul or import of soil necessary to meet finish grades indicated on the Drawings.
3. Excavation, backfill and compaction for filling construction and trenches.

C. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. For additional information, refer to Geotechnical Engineering Investigation With Geologic Hazards Evaluation prepared by Salem Engineering Group, dated September 29, 2020, and updates thereof.
3. Section 01 2500: Substitution Procedures
4. Section 01 4520: Testing and inspection requirements.
5. Section 01 5725: Storm Water Pollution Protection Plan.
6. Section 01 7120: Field engineering.
7. Section 22 0000: Excavation and backfill for plumbing work.
8. Section 26 6000: Excavation and backfill for electrical work.
9. Section 31 1000: Site clearing
10. Section 31 3115: Termite control.
11. Section 31 4300: Compaction grouting.
12. Section 32 9000: Top soil amendments and soil preparation for plantings.
13. Section 32 9000: Soil mix for baseball infield and running track.

1.2 QUALITY ASSURANCE

A. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

B. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the geotechnical engineer.

C. Verify all grade and trench elevations as specified in Section 01 7120.

D. All improvements within property owned by a City, County or State Entity shall be in accordance with the Standard Specifications of the authority having jurisdiction.

1.3 TRENCHING AND EXCAVATION SAFETY

A. All trenches and excavation in excess of 4'-0" in depth and areas of visibly unstable soils shall be shored or otherwise stabilized in conformance with current local or state codes, ordinances and requirements. In addition,

the Contractor shall notify the Owner of suspected hazardous waste or other unusual physical conditions as provided by law.

B. All open trenches and excavations outside the fenced construction area shall be properly barricaded for public and worker safety. Trenches shall be adequately covered or backfilled prior to ceasing work or leaving the work site.

C. Slope height, slope inclination, and excavation depths (including utility trench excavations) must in no case exceed those specified in local, state, or federal safety regulations, (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations).

1.4 EXISTING UTILITIES

A. Field verify the location of all existing underground utilities prior to beginning any earthwork. Work around and protect all existing utilities during the course of the Work. Raise or lower each existing utility box flush with new finish surface.

B. Where existing utilities are indicated on the drawings, extreme care shall be exercised in excavating near these utilities to avoid damage, and the Contractor will be held responsible for any damage caused by construction operations.

C. Should utilities not indicated on the drawings be found during construction, the Contractor shall promptly notify the Architect for instructions as to further action. Failure to do so will make the Contractor liable for any damage arising from construction operations after discovery of these utilities.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 SOIL MATERIALS

A. Fill and Backfill Materials: Fill shall consist of select material. Native soil, free from organic matter and rocks or cobbles larger than 3", may be used as fill at the site as follows:
   1. Satisfactory Soil Materials: Are defined as those complying with ASTM D2487 Soil Classification Groups GW, GP, GM, SM, SW, and SP.
   2. Unsatisfactory Soil Materials: are defined as those complying with ASTM D2487 Soil Classification Groups GC, SC, MH, ML, CL, CH, OL, OH, and PT.

B. Import Material: Import material, if required, shall consist of homogenous, non-corrosive, non-expansive, inorganic granular soils free of toxic materials and conforming to the following criteria:
   1. Gradation:
      a. 3" Sieve: 100% passing
      b. No. 4 Sieve: 75-100% passing
      c. No. 200 Sieve: 15-40% passing
   2. Plasticity Index, ASTM D4318:
      a. Liquid limit: < 25
      b. Plasticity index: 15

3. Expansion Index: 20
4. Organic Content: < 3% by dry weight.
5. Minimum "R" Value (pavement area): 50
6. Corrosivity:
   a. pH: 6 to 8
   b. Minimum resistivity (ohm-cm): > 2,000
   c. Soluble sulfate (ppm): < 2,000
   d. Soluble chloride (ppm): < 500
7. Import fill material shall be approved by the geotechnical engineer prior to transport to the site and provided at no additional cost to the Owner.

C. Engineered Fill Materials:
1. Satisfactory Soil Materials as defined in paragraph 2.2.A.1 above, or
2. Import Material defined in 2.2.B above.

D. Sand for Utility Bedding: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

E. Toxic Testing of Import Fill Material:
1. The Contractor shall notify the Owner, Architect, and Testing Laboratory for the project, of the location and origin of all fill material intended for this project. Such notification shall be not less than 21 days prior to transport of the material.
2. Both native and stockpile soils shall be subject to testing to determine suitability of the soil as related to toxic substances on school sites.
3. The Owner will pay for only one passing test from one import source. Additional tests, and retests of failed material shall be paid by the Contractor.
4. Should testing indicate toxic substances at levels above those acceptable on school sites by the State of California, Department of Toxic Substance Control (DTSC), the subject soil will not be permitted on the proposed school site.
5. Any delay caused by materials found not to be compliant, shall not be accepted as justification for contract time extension or related claims.

2.3 TOPSOIL

A. Topsoil:
1. Friable, fertile soil of loamy character, containing an amount of organic matter normal to the region, capable of sustaining healthy plant life, and reasonably free from subsoils, roots, heavy or stiff clay, stones and gravel, noxious weeds, sticks, brush, litter, and other deleterious matter.
2. Provide from stockpile developed on site as specified in Section 31 1000.

2.4 ACCESSORY MATERIALS

A. Utility Identification Tape: 2" wide metallic plastic material inscribed with caution message related to the buried utility below (i.e., **ELECTRICAL LINE BURIED BELOW, SEWER LINE BURIED BELOW**, etc.) by McMaster-Carr or approved equal.

B. Provide a dry, free-flowing, dust-free chemical compound, soluble in water, capable of inhibiting growth of vegetation, and approved for use on this Work by governmental agencies having jurisdiction.

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 FINISH ELEVATIONS AND LINES

A. Comply with pertinent provisions of this Section, Section 01 7120, and the Grading Plan.

3.3 DEWATERING AND WATER CONTROL

A. Water Control:
1. Establish and construct storm drainage features at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils.
2 Completely drain construction site during periods of construction to keep soil materials sufficiently dry.
3. Temporary excavations for the project construction should be left open only for as short a time as possible and should be protected from water runoff.

B. Dewatering:
1. Remove all water, including rain water, encountered during trench and substructure work to an approved location by pumps, drains, and other approved methods.
2. Keep excavations and site construction area free from water.
3. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
4. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations.
5. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from open excavations, unfinished fills, or other low areas to prevent softening of exposed surfaces.
6. Dispose of water away from the work in a suitable manner without damage to adjacent property or menace to public health.
7. Protect existing storm drain system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the Owner.

C. Unsuitable Soil Support: When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified.

3.4 DUST CONTROL

A. The San Joaquin Valley Air Pollution Control District regulates all dust control and emission standards throughout the Central Valley. Regulation VIII – Fugitive PM10 Prohibitions requires that a Dust Control Plan be completed for a large majority of construction projects.

B. The Contractor shall implement all measures listed in the Dust Control Plan as required for the project.

C. Construction work shall not commence until the Dust Control plan is completed and approved by the District.

D. Whether a Dust Control Plan is required for the project or not, the Contractor shall be responsible for complying with the requirements of Rule 8021.

3.5 PROCEDURES

A. Utilities:
1. Unless shown to be removed, protect active utility lines shown on the Drawings or otherwise made known to the Contractor prior to excavating. If damaged, repair or replace at no additional cost to the Owner.
2. If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Architect and secure his instructions.
5. Do not proceed with permanent relocation of utilities until written instructions are received from the Utility Company.

B. Protection of Persons and Property:
1. Barricade open holes and depressions occurring as part of this Work, and post warning lights on property adjacent to or with public access.
2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

C. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

D. Maintain access to adjacent areas at all times.

3.6 BORING

A. Provide mechanical boring equipment to bore under existing asphalt, concrete, or other surfaces or objects as noted on the drawings. All borings shall be a minimum of 24" under the substrate material unless otherwise authorized by the Architect.

B. Holes shall be bored not to exceed 1" larger diameter than the largest component remaining in the excavation.

C. **Water or air pressure jetting** are not permitted, unless they comply with the following requirements.
1. All surfaces of the hole can be visually inspected with 6' maximum length and,
2. All objects shall be supported continuously to prevent sagging and,
3. The hole shall be filled with compacted damp sand and inspected by the Project Inspector or Materials Testing Lab technician.

D. Comply with requirements of Section 01 7330.

3.7 SITE PREPARATION

A. Over-excavation and Preparation at Buildings:
1. After clearing, excavate native soils in areas indicated to a depth of 1'-0" below stripped ground surface, or 1'-0" below bottom of proposed footing, , or to the depth required to remove any undocumented fills, whichever is deeper.
2. At a minimum, include entire building areas, and extend at least 5'-0" beyond exterior footing line, including 5'-0" beyond exterior column footing edges.
3. Remove roots and other vegetation remaining in excavated area which are larger than ½" in diameter.
4. Scarify bottom of excavation to minimum depth of 12".

5. Bring moisture conditions to above optimum moisture content and compact excavated area to a minimum of 92% of maximum dry density; ASTM D1557. The subgrade, to a depth of 24 inches, shall have a moisture content of at least 4 percent above optimum, immediately prior to pouring the slab or placing a vapor barrier; ASTM D3017.
6. Place engineered fill materials required to establish finish grade in lifts no greater than 8" loose depth and compact to a minimum of 92% of maximum dry density; ASTM D1557.

B. Over-excavation and Preparation at Asphalt Pavement:
1. Excavate native soils to a minimum depth of 1'-0" below the bottom of pavement subgrade or existing subgrade, whichever is deeper, in an area extending a minimum of 3'-0" beyond the edge of the pavements.
2. Remove roots and other vegetation remaining in excavated area which are larger than ½" in diameter.
3. Scarify bottom of excavation to minimum depth of 8".
4. Bring moisture conditions to above optimum moisture content and compact excavated area to a minimum of 95% of maximum dry density; ASTM D1557. The subgrade, to a depth of 24 inches, shall have a moisture content of at least 4 percent above optimum; ASTM D3017.
5. Place engineered fill materials required to establish finish grade in lifts no greater than 8" loose depth and compact to a minimum of 95% of maximum dry density; ASTM D1557.
6. Compact the top 12" of subgrade to a minimum of 95% of maximum dry density; ASTM D1557.

C. Over-excavation and Preparation at Site Concrete:
1. Excavate native soils to a minimum depth of 1'-0"below the bottom of concrete subgrade or existing subgrade, whichever is deeper, in an area extending a minimum of 3'-0" beyond the edge of the improvements.
2. Remove roots and other vegetation remaining in excavated area which are larger than ½" in diameter.
3. Scarify bottom of excavation to minimum depth of 12".
4. Bring moisture conditions to above optimum moisture content and compact excavated area to a minimum of 90% of maximum dry density; ASTM D1557. The subgrade, to a depth of 24 inches, shall have a moisture content of at least 4 percent above optimum, immediately prior to pouring concrete or placing a vapor barrier; ASTM D3017.
5. Place engineered fill materials required to establish finish grade in lifts no greater than 8" loose depth and compact to a minimum of 95% of maximum dry density; ASTM D1557.
6. Compact the top 12" of subgrade to a minimum of 95% of maximum dry density; ASTM D1557.

D. Root Removal at Trees:
1. Completely remove root systems to a minimum depth of 36" below the bottom of the lowest structure or footing or 36" below finished subgrade, whichever is lower.
2. Excavate root systems deeper than the elevation indicated above to allow no roots larger than 1" in diameter.
3. Treat roots remaining in the soil with a weed killer approved by the State of California for that purpose.
4. Backfill cavities resulting from root removal with earth materials placed and compacted as required by this Section.l

3.8 EXCAVATION

A. Perform excavation of every type of material encountered within the limits of the Work to the lines, grades, and elevations indicated and specified herein.

B. Earth excavation includes excavation of pavements and other obstructions visible on ground surface; underground structures, utilities and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.

C. Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42" wide bucket on a track-mounted power excavator equivalent to Caterpillar Model 215, rated at not less than 90 HP flywheel power and 30,000 lb. drawbar

pull. Trenches in excess of 10'-0" in width and pits in excess of 30'-0" in either length or width are classified as open excavation.

D. Surplus Materials: Dispose of unsatisfactory excavated materials, and surplus satisfactory excavated material, away from the site at disposal areas arranged and paid for by the Contractor.

E. Additional Excavation: When excavation has reached required subgrade elevations, notify Architect who will make an inspection of conditions. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Architect/Engineer. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

F. Excavate and backfill in a manner and sequence that will provide proper drainage at all times.

G. Unauthorized Excavation:
1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific instruction from the Architect or the geotechnical engineer.
2. Under footings, foundations, or retaining walls:
   a. Fill unauthorized excavation by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering the required top elevation.
   b. When acceptable to the geotechnical engineer, lean concrete (minimum 2000 psi) may be used to bring bottom elevations to proper position.
3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations, unless otherwise directed by the geotechnical engineer.

H. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

I. Stability of Excavations:
1. Slope sides of excavation to comply with local codes and ordinances having jurisdiction.
2. Shore and brace where sloping is not possible because of space restrictions or stability of the materials being excavated.
3. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

J. Shoring and Bracing:
1. Provide materials for shoring and bracing as may be necessary for safety of personnel, protection of work, and compliance with requirements of governmental agencies having jurisdiction.
2. Maintain shoring and bracing in excavations regardless of the time period excavations will be open.
3. Carry shoring and bracing down as excavation progresses.

K. Use of Explosives: **NOT PERMITTED**.

3.9 FILLING AND BACKFILLING

A. Backfill excavations as promptly as progress of the Work permits, but not until:
1. Acceptance of construction below finish grade:
2. Inspecting, testing, approving, and recording locations of underground utilities;
3. Concrete formwork is removed;
4. Shoring and bracing are removed, and voids have been backfilled with satisfactory materials;
5. Trash and debris have been removed; and
6. Horizontal bracing is in place on horizontally supported walls.

B. Placing and Compaction:
1. Place backfill and fill materials in layers not more than 8" in loose depth.

2. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content.
3. Compact each layer to required percentage of maximum density for the area.

C. Moisture Content:
1. When the moisture content of fill material is below the lower limit specified by the Geotechnical Engineer, add water until the moisture content is as specified.
2. When the moisture content of fill material is above the upper limit specified, the material shall be aerated by blading or other satisfactory methods until the moisture content is as specified.
3. Do not place, spread, or compact fill while it is frozen or thawing or during unfavorable weather conditions. When work is interrupted by weather conditions, do not resume fill operations until moisture content and density of previously placed fill are satisfactory.
4. Where soil has been softened or eroded by flooding, by placement during unfavorable weather, remove damaged areas and recompact as described for fill and compaction.
5. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
6. Where subgrade is spongy or pumping due to conditions beyond the Contractor's control, and aeration or other methods do not bring moisture content within specified levels, stop work and contact the Architect and Geotechnical Engineer for further direction.

3.10 TOPSOIL

A. Place topsoil to the following compacted thicknesses:
1. Areas to be seeded: 6"
2. Areas to be sodded: 4"
3. Shrub beds: 18"
4. Flower beds: 12"

B. Topsoil Placement:
1. Where topsoil is to be placed, scarify surface to depth of 6".
2. Place topsoil during dry weather.
3. Remove roots, weeds, rocks, and foreign material while spreading.
4. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
5. Roll placed topsoil.

3.11 TRENCHING

A. Trenching:
1. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
2. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
3. Do not interfere with 45 degree bearing splay of foundations.
4. Cut trenches wide enough to allow inspection of installed utilities.
5. Hand trim excavations. Remove loose matter.
6. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
7. Remove lumped subsoil, boulders, and rock up to 1.0 cu yd measured by volume.
8. Remove excavated material that is unsuitable for re-use from site.
9. Stockpile excavated material to be re-used in area designated on site in accordance with this Section 31 2000.
10. Remove excess excavated material from site.

B. Preparation for Utility Placement:
1. Cut out soft areas of subgrade not capable of compaction in place. Backfill with engineered fill.
2. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

3. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

C. Backfilling:
1. Backfill to contours and elevations indicated using unfrozen materials.
2. Employ a placement method that does not disturb or damage other work.
3. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
4. Maintain optimum moisture content of fill materials to attain required compaction density.
5. Slope grade away from building. Make gradual grade changes. Blend slope into level areas.
6. Correct areas that are over-excavated.
7. Reshape and re-compact fills subjected to vehicular traffic.

D. Utility Installation: Install underground utilities according to the manufacturer's written recommendations. In addition to the manufacturer's recommendations, install underground utilities as follows:
1. Underground Utility Line Cover: No less than 12".
2. Bedding: Pipe bedding, haunches and initial fill extending to 1 foot above the pipe should consist of a clean well graded sand with 100 percent passing the #5 sieve, a maximum of 15 percent passing the #200 sieve, and a minimum sand equivalent of 20.
3. Envelope: Compacted sand extending 6" above and around the pipe or conduit.
4. Backfill Material: Remaining backfill material may consist of native soil or engineered fill material as described above.
5. Place and compact utility trench backfill in accordance with the requirements for engineered fill.

E. Utility Identification:
1. Utility Identification Tape: 2" wide metallic plastic material inscribed with a CAUTION message related to the buried utility.
2. Identify each utility pipe or conduit by the use of a continuous underground warning tape.
3. Locate tape 12" directly above the pipe or conduit, but not more than 12" below or not less than 6" below the finished grade.
    a. Where the top of the pipe or conduit exceeds 4'-0" below finish surface, locate one tape 12" directly above the pipe or conduit and one tape not less than 6" below the finished grade.
4. Provide one strip of identification tape for each 18" of trench width, horizontally.

3.12 HARDPAN

A. Hardpan Removal:
1. Remove hardpan to a depth of 12" minimum. Where encountered, the contractor should anticipate increased excavation effort. Hardpan fragments will require processing and blending with onsite soils prior to use as engineered fill. Refer to the Geotechnical Report and any supplemental reports and/or consult with the Geotech engineer for recommendations.
2. Compact import fill as specified in this Section.

B. Hardpan Ripping and Grinding:
1. Cross rip hardpan to a depth of 16".
2. Grind ripped hardpan section to a depth of 8"
3. Where encountered, the contractor should anticipate increased excavation effort. Hardpan fragments will require processing and blending with onsite soils prior to use as engineered fill. Refer to the Geotechnical Report and any supplemental reports and/or consult with the Geotech engineer for recommendations.

3.13 GRADING

A. General: Uniformly grade the areas within limits of grading under this Section, including adjacent transition areas. Smooth the finished surfaces within specified tolerance.

B. Finish Grading Outside Building Lines:
   1. Grade areas adjacent to buildings to achieve drainage away from the structures, and to prevent ponding.
   2. Finish the surfaces to be free from irregular surface changes, and:
      a. Shape the surface of areas scheduled to be under walks to line, grade, and cross-section, with finished surface not more than 0.10 foot above or below the required subgrade elevation.
      b. Shape the surface of areas scheduled to be under pavement to line, grade, and cross-section, with finished surface not more than 0.10 feet above or below the required subgrade elevation.
      c. Shape finish grade adjacent to building to slope a minimum of 2% away from the exterior footings and wall, for a distance of 5'-0".

3.14 COMPACTION

A. Control soil compaction during construction to provide the minimum percentage of density specified for each area as determined according to ASTM D1557.

B. Moisture Control: Where subgrade or layer of soil material must be moisture-conditioned before compacting, uniformly apply water to surface of subgrade or layer of soil material to prevent free water appearing on surface during or subsequent to compacting operations.

C. Densities: Provide not less than the following maximum density of soil material compacted at each layer of soil material in place, and as approved by the geotechnical engineer.
   1. Buildings, Asphalt Paving and Site Concrete: As specified in the Geotechnical Report
   2. Lawn and unpaved areas: Compact the top 6" of subgrade and each layer of fill material or backfill material at 85% of maximum density;
   3. **Trenches:** Provide a minimum of 3" of compacted sand bedding under pipe or conduit, and provide envelope extending 12" above pipe or conduit. Compact remaining backfill to 90% of maximum density except the upper 24" of those trenches located within structures, walks, and pavement areas which shall be compacted as specified in section 3.7.

3.15 FIELD QUALITY CONTROL

A. Secure the Geotechnical Engineer's inspection and approval of subgrades and fill layers before subsequent construction is permitted thereon.

B. The Owner's testing laboratory will provide at least the following tests:
   1. At paved areas, at least 1 field density/moisture test for every 10,000 sq. ft. of paved area, but not less than 3 tests.
   2. In each compacted underlying fill layer, 1 field density/moisture test for every 7,500 sq. ft. of overlaying paved area, but not less than 3 tests.
   3. In building areas, at least 1 field density/moisture test for every 2,000 sq. ft. of building coverage.
   4. At least 1 field density/moisture test per every 200 lineal foot of trench over 3'-0" of trench depth.

C. If, in the Geotechnical Engineer's opinion based on reports of the testing laboratory, subgrade or fills which have been placed are below specified density, provide additional compacting and testing under the provisions of Section 01 4520 of these Specifications.

END OF SECTION 31 2000

SECTION 31 3115 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Provide soil poisoning to control subterranean termites as specified herein and needed for a complete and proper treatment.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 31 2000: Earthwork.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures. **Provide additional copy of manufacturer's application recommendations and rates, to Architect and Inspector of Record, not less than 72 hours prior to application of termite treatment.**

1.3 QUALITY ASSURANCE

A. Qualifications of Applicator:
1. Properly licensed to provide such services by governmental agencies having jurisdiction.
2. Not less than five years' successful experience in soil treatment for subterranean termites.

1.4 SPECIAL WARRANTY

A. Upon completion of the Work, and as a condition of its acceptance, deliver to the Architect two copies of a special warranty and maintenance agreement signed by an authorized representative of the installing subcontractor, and co-signed by the Contractor, agreeing:
1. To make an inspection of the Work once each year for a total period of five years following Date of Substantial Completion for the purpose of detecting termite infestation;
2. If termite infestation is found during that five year period, to retreat in accordance with prevailing practices of the trade and within ten calendar days after such infestation is discovered;
3. To repair damage to the Work caused by termites during that five year period, to a maximum cost of $5,000;
4. To make such inspections, retreatment, and repairs at no additional cost to the Owner.
5. This Warranty and Maintenance Agreement shall be in addition to the warranty requirements of the Contract Documents, and the enforcement of its provisions, shall not deprive the Owner of any action, right, or remedy otherwise available to him.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions and requirements of State of California, and EPA.

PART 2 - PRODUCTS

2.1 TERMITE CONTROL MATERIALS

A. Acceptable Products:
1. Wisdom TC Flowable by AMVAC.
2. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Product Characteristics:
1. Approved by governmental agencies having jurisdiction.
2. Active ingredients: Minimum of 7.9% Bifenthrin.

C. If combinations of toxicants are approved by governmental agencies having jurisdiction, provide toxicants having such approval and in the maximum strength so approved, at no additional cost to the Owner.

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 APPLICATION

A. Apply toxicant at following locations:
1. Under slabs-on-grade.
2. At both sides of foundation surface.

B. Place all termite control materials in strict accordance with the manufacturer’s requirements and recommendations. Follow printed labels and instructions in a manner as to provide complete coverage without jeopardizing public safety.

END OF SECTION 31 3115

SECTION 32 1210 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide asphalt paving, aggregate base, and wheel stops where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1. The Work of this Section includes patching and repair of asphaltic concrete paving removed for installation of underground utilities.
2. The work of this Section includes patching and repair of asphaltic concrete paving removed for installation of new work.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Contractor shall comply with State of California Department of Transportation Standard Drawings and Specifications, published January 2024, wherever noted on the plans.
3. For additional information, refer to Geotechnical Engineering Investigation With Geologic Hazards Evaluation prepared by Salem Engineering Group, dated September 29, 2020, and updates thereof.
4. Section 31 2000: Earthwork
5. Section 32 1720: Pavement Marking

1.2 COMPENSATION FOR ASPHALT OIL

A. The compensation payable for asphalt oil will be increased or decreased in conformance with the provisions of this section for fluctuations in crude oil prices exceeding 5 percent higher or lower than the price index at the time of bid.

B. The adjustment in compensation in each monthly billing will be determined in conformance with the formulae indicated in Exhibit A attached at the end of this section.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 3300.
1. Manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Certificates, signed by the asphaltic concrete paving materials producer and the asphaltic concrete paving subcontractor, stating that materials meet or exceed the specified requirements.

1.4 QUALITY ASSURANCE

A. All improvements within property owned by a City, County or State Entity, shall be in accordance with the Standard Specifications of the authority having jurisdiction.

1.5 SPECIAL WARRANTY

A. In addition to the warranty requirements of the Contract Documents, provide a material and workmanship warranty signed by an authorized representative of the installing subcontractor and cosigned by the Contractor with an extended warranty correction period of 2-years.

PART 2 - PRODUCTS

2.1 GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 6200.

B. All materials and products shall be in conformance with the current construction standards and construction specifications of the governing jurisdiction.

2.2 ASPHALT CONCRETE

A. Asphalt Concrete: Type B; Standard Specifications Section 39, California Department of Transportation, 2024 edition.

B. Aggregate: 1/2" maximum (medium).

C. Asphalt Binder: Steam refined paving asphalt classified as PG 64-10; Section 92 of the State of California Standard Specifications, 2024 edition.

2.3 AGGREGATE BASES, SUBBASES, AND RECYCLED BASES

A. Aggregate Bases:
1. Class 2 conforming to Section 26 of the Caltrans Specifications, 2024 edition.
2. Gradation: As specified for 3/4" or 1 ½ " maximum aggregate.

B. Aggregate Subbase:
1. Conform to Section 25 of the Caltrans Specifications, 2024 edition.
2. Class as noted on the Drawings.

C. Recycled Base and Subbase Courses: Aggregate base or subbase may be composed of salvaged oiled earth and asphalt concrete from the existing roadway recycled and mixed with imported materials to meet the requirements of the base or subbase class noted on the Drawings.
1. Contractor shall be responsible for paying for “R” Value testing and other required testing of the salvaged materials.
2. Contractor must show that “R” Value and other properties of the salvaged material meets or exceeds the requirements of the base or subbase class noted on the Drawings.
3. The amount of recycled/reclaimed material in the mix may be up to 100 percent of the total volume of the aggregate used.

2.4 OTHER MATERIALS

A. Weed Killer: SFM 75 by Alligare.

B. Wheel Stops: 6"x6"x48" reinforced precast concrete with two 3/4"x24" steel anchor pins set in epoxy.

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 FINAL PREPARATION OF SUBGRADE

A. After preparation of subgrade as specified in another Section of these Specifications, thoroughly scarify and sprinkle the entire area to be paved, and then compact to a smooth, hard, even surface of 95% compaction to receive the aggregates.

B. Apply the specified weed killer to the entire area to be paved. Adhere to the manufacturer's application recommendations.

3.3 PLACEMENT OF BASE COURSES

A. Base:
1. Spread specified base material to a thickness providing the compacted thickness indicated.
2. Place in lifts not exceeding 6" in thickness.
3. Compact to 95%.

B. Moisture Content: Use only the amount of moisture needed to achieve the specified compaction.

3.4 PLACEMENT OF ASPHALTIC CONCRETE PAVING

A. Install the specified headers and stakes to achieve the arrangement of paving indicated.

B. Remove all loose materials from the compacted base.

C. Apply the specified prime coat, and tack coat where required, and allow to dry, in accordance with the manufacturer's recommendations.

D. Adjust frames and covers, if so required, to meet final grades.

E. Receipt of Asphaltic Concrete Materials:
1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 280 degrees F.
2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 50 degrees F, nor during fog, rain, or other unsuitable conditions. Begin placement only when temperature is above 51 degrees F **and rising**.

F. Spreading:
1. Spread material in a manner which requires the least handling.
2. Where thickness of finished paving will exceed 2.5", spread in two or more layers, with top layer no thinner than 1.5". No lift shall exceed 2.5".
3. Provide compacted thicknesses shown on the Drawings within a tolerance of minus 0.0" to plus 0.5".

G. Rolling:
1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the Drawings.
2. Roll in at least two directions until no roller marks are visible.
3. Finished paving smoothness tolerance:
    a. Free from birdbaths.
    b. No deviations greater than 1/8" in 6 feet.

c. Compact to a maximum relative compaction of 97%, with no single test value being below a minimum relative compaction of 91% based on a 50 blow Marshall maximum density.
d. Percentage of voids shall not exceed 9%

3.5 FLOOD TEST

A. Perform a flood test in the presence of the Architect.

B. Method: Flood the entire asphaltic concrete paved area with water by use of a tank truck or hoses.
1. If a depression is found where water ponds to a depth of more than 1/8" in six feet, fill or otherwise correct to provide proper drainage.
2. Feather and smooth the edges of fill so that the joint between fill and original surface is invisible.

3.6 INSTALLING WHEEL STOPS

A. Install the specified precast concrete wheel stops as shown on the Drawings, driving the approved 3/4" dia. anchor pins not less than 2'-0" through the paving into the earth.

3.7 FIELD QUALITY CONTROL

A. Secure the geotechnical engineer's inspection and approval of subgrades before subsequent construction is permitted thereon.

B. In-Place Density: Owner's testing laboratory will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D2726.
a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.

C. In-place Compacted Thickness: Owner's testing laboratory will determine compacted thickness according to ASTM D3549.

D. Repair or remove and replace unacceptable paving as directed by the Architect.

E. Replace and compact asphalt where core tests were taken.

END OF SECTION 32 1210

EXHIBIT "A"

COMPENSATION ADJUSTMENTS FOR CRUDE OIL PRICE INDEX FLUCTUATIONS

The compensation payable for asphalt oil will be increased or decreased in conformance with the provisions of this Exhibit "A" for crude oil fluctuations more than 5 percent higher or lower than the price index at the time of bid.

The adjustment in compensation will be determined In conformance with the following formula:

DETERMINE ASPHALT QUANTITIES:

Calculate the quantity of asphalt oil in hot mix asphalt using the following formula:

Qh = HMATT x [Xa / (100 + Xa)]

Qh = quantity in tons of asphalt oil used in hot mix asphalt

HMATT = hot mix asphalt total tons placed

Xa = theoretical asphalt oil content from job mix formula expressed as percentage of the weight of dry aggregate

DETERMINE PAYMENT ADJUSTMENTS:

If material containing asphalt oil is placed within multiple months, calculate separate adjustments for each month.

Each adjustment is calculated using the price index for the month in which the quantity of material containing asphalt oil subject to adjustment is placed in the work. The sum of all the adjustments is used for increasing or decreasing payment.

Calculate each payment adjustment as follows:

PA = Qh x A

PA = Payment adjustment in dollars for asphalt oil contained in materials placed in the work for a given month.

Qh = quantity in tons of asphalt oil used in hot mix asphalt.

A = Adjustment in dollars per ton of asphalt oil used to produce materials placed in the work rounded to the nearest $0.01.

A = [(Iu / Ib) - 1.05] x Ib x [1 + (T / 100)] for an **increase** in the crude oil price index exceeding 5%

A = [(Iu / Ib) - 0.95] x Ib x [1 + (T / 100)] for a **decrease** in the crude oil price index exceeding 5%

Iu = California Statewide Crude Oil Price Index for the month in which the quantity of asphalt oil subject to adjustment was placed in the work.

Ib = California Statewide Crude Oil Price Index for the month in which the bid opening for the project occurred

T = Sales and use tax rate, expressed as a percent, currently in effect in the tax jurisdiction where the material is placed. If the tax rate information is not submitted timely, the statewide sales and use tax rate is used in the payment adjustment calculations until the tax rate information is submitted.

ADJUST THE CONTRACT SUM:

The Contract Sum will be increased or decreased based on the sum of the Payment Adjustments.

If the price index at the time of placement increases:

50% percent or more over the price index at bid opening, notify the Architect.

100% or more over the price index at bid opening, do not furnish material containing asphalt oil until the Architect authorizes the work to proceed. The Owner decrease or eliminate asphalt paving work.

The adjustment shall also be subject to the following:

The Contractor shall be liable to the Owner for decreased compensation adjustments and the Owner may deduct the amount thereof for moneys due or that may become due the Contractor.

In the event of an overrun of contract time, adjustment in compensation for asphalt oil during this overrun period will be determined using the California Statewide Crude Oil Price Index in effect on the first business day of the month within the month in which the overrun began.

CALIFORNIA STATEWIDE CRUDE OIL PRICE INDEX:

The California Statewide Crude Oil Price Index is determined each month on or about the 1st business day of the month by the California Department of Transportation using the average of the posted prices in effect for the previous month as posted by Chevron, ExxonMobil, and ConocoPhillips for the Buena Vista, Huntington Beach, and Midway Sunset fields.

If a company discontinues posting its prices for a field, the California Department of Transportation determines the index from the remaining posted prices. The Department may include additional fields to determine the index.

For the California Statewide Crude Oil Price Index, go to:

http://www.dot.ca.gov/hq/construc/crudeoilindex/

SUBMITTALS:

Before placing material containing asphalt oil, submit the current sales and use tax rate in effect in the tax jurisdiction where the material is to be placed.

Submit certified weight slips for hot mix asphalt, including those materials not paid for by weight.

SECTION 32 1720 - PAVEMENT MARKING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide pavement marking in the types and arrangements shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
   1. Crosswalk, striping and graphics.
   2. Parking lot striping and graphics.
   3. Other lines and graphics as indicated.

B. Related Sections:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
   1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
   2. Installation Procedures: Submit manufacturer's recommended installation procedures.
   3. Shop Drawings: Photographs, scale drawings, or other data acceptable to the Architect, showing types of graphics proposed to be used.

PART 2 - PRODUCTS

2.1 MATERIALS GENERAL

A. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.1 PAVEMENT MARKING PAINT

A. Provide paint specifically formulated for use as pavement marking in automobile traffic areas, and in the colors selected by the Architect from standard no lead colors of the approved manufacturer.
   1. Slip-resistant coefficient of friction ≥ 0.6; ADA Standard A4.5.1, for all paint.
   2. Blue at accessible parking to be color #15090; Federal Standard 595B or equal.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following
   1. Zoneline by PPG Architectural Coatings; 100% acrylic.
   2. SetFast Acrylic Waterborne Traffic Marking Paint by Sherwin-Williams.
   3. Vin-L-Stripe W801 Series by Dunn-Edwards.
   4. 506 Traffic Paint by Frazee; 100% acrylic.

2.2 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.

B. Allow a minimum of 24 hours before applying striping over asphalt paving fog seal.

3.2 APPLICATION

A. Secure the Architect's approval of graphics design and layout prior to start of application.

B. Using proper masking, stencils, and application equipment recommended for the purpose by the manufacturer of the approved paint, apply the approved paint in strict accordance with its manufacturer's recommendations.

C. **Provide 2 coats** of paint material at all markings.

3.3 PROTECTION

A. Provide traffic cones, barricades, and other devices needed to protect workmen and the paint until it is sufficiently dry to with-stand traffic.

3.4 CLEANUP

A. When paint is thoroughly dry, visually inspect the entire application, touchup as required to provide clean, straight lines and surfaces throughout.

B. Using a permanently opaque paint identical in color to the surface on which the paint was applied, block out and eliminate all traces of splashed, tracked, and/or spilled pavement marking paint from the background surfaces.

END OF SECTION32 1720

SECTION 32 1725 - TACTILE WARNING SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide tactile warning surface mats and accessories in the types and arrangements shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Samples: Submit 3 samples of each kind or type of tile.

1.3 QUALITY ASSURANCE

A. Americans with Disabilities Act (ADA): Provide tactile warning surfaces which comply with the detectable warnings on walking surfaces section of the ADA (Title 49, CFR Transportation, Part 37.9 Standards for Accessible Transportation Facilities, Appendix A, Section 4.29.2 Detectable Warnings on Walking Surfaces.

B. Applicable provisions of California Building Code.

PART 2 - PRODUCTS

2.1 TACTILE WARNING TILE

A. Acceptable Manufacturers: "In-line" pattern, ADA/CBC compliant detectable warning mat and accessories from one manufacturer. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following;
1. Ada Solutions, Inc., (800) 372-0519.
2. Engineered Plastics Inc., (800) 682-2525.
3. Advantage Tactile Systems Inc., (800) 679-4022.
4. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Color: Detectable warning surfaces shall be yellow and approximate 33538 of SAE AMS-STD-595A.

C. Accessories:
1. Adhesive: Manufacturer’s recommended adhesive.
2. Anchors: Color matched, corrosion-resistant, flat-head drive anchor; 1/4" diameter by 1-1/2" long provided by manufacturer.
3. Sealant: Manufacturer’s recommended sealant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install tactile warning surfaces, adhesive, anchors, and sealant in accordance with the manufacturer's written installation instructions.

B. Set tactile warning surfaces true and square to the curb ramp area.

END OF SECTION 32 1725

SECTION 32 1810 - PLAYGROUND SURFACING TILES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide Resilient, interlocking, playground safety surfacing tiles and related materials as indicated on the Drawings, specified herein, and needed for a complete and proper installation. Section includes:
   1. Playground surfacing.

B. Related Sections:
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
   2. Section 03 3000: Cast In Place Concrete
   3. Section 31 2000: Earthwork
   4. Section 33 4000: Storm Drainage

C. References:
   1. ASTM C 67 – Standard Test Method Methods for Sampling and Testing Brick and Structural Clay Tile.
   2. ASTM C 501 – Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abrader.
   3. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.
   4. ASTM D 573 – Standard Test Method for Rubber-Deterioration in an Air Oven.
   5. ASTM D 624 – Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
   6. ASTM D 2047 – Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
   7. ASTM D 2859 – Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.
   8. ASTM D 3676 – Standard Specification for Rubber Cellular Cushion Used for Carpet or Rug Underlay.
   9. ASTM E 303 – Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.
   10. ASTM F 1292 – Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.
   11. US Consumer Product Safety Commission (CPSC) Handbook for Playground Safety.

1.2 DEFINITIONS

A. Use Zone: The area beneath and immediately adjacent to a play structure or equipment (play event) that is designated for unrestricted circulation around equipment, and on whose surface it is predicted that a user would land when falling from or exiting the equipment.

B. Critical Fall Height: The maximum fall height at which the protective surfacing meets the requirements of ASTM F1292.

C. High Play Activity Area: Areas where the fall height is especially great, such as at swings. A high play activity area is defined only where the protective surfacing of the entire playground area is not designed for the greatest fall height. High play activity areas are defined on the drawings.

D. Fall Height: The vertical distance between the finished elevation of the designated play surface and the finished elevation of the protective surfacing beneath it as defined by ASTM F1487.

E. Protective Surfacing: Resilient ground surfacing. The characteristics of the protective surfacing are based on the fall height of the playground equipment. Changes in either the surfacing or the fall height, particularly reducing the resilience of the protective surfacing or increasing the fall height, will reduce safety-related performance.

F. Subgrade: The surface of the ground on which the protective surfacing is installed.

1.3 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
a. Include IPEMA certifications where required.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Detailed scale drawings showing locations of existing playground equipment and exposed footings, bases, and anchorage points.
a. Clearly identify footing and base elevations in relation to a fixed survey point on site and to subgrade elevation and depth of protective surfacing, surveyed by land surveyor licensed in the State in which the Project is located.
b. Show locations of underground utilities, storm-drainage system and irrigation system.
c. Show locations of related construction such as walkways and roadways, fences, site furnishings, and plantings.
d. Show measured fall height for each playground equipment item; ASTM F1487.
e. Show Use Zone perimeters; ASTM F1487.
4. Certification: Provide IPEMA certification of ASTM F1292 Critical Fall Height at thickness specified.
5. Three samples of safety surface for this project, minimum of 6" x 6" in size.
6. Test Reports: Submit certified test reports from qualified independent testing agency indicating results of the following tests:
a. Impact Attenuation: ASTM F 1292.
b. Freeze Thaw: ASTM C 67.
c. Rubber Deterioration/Air Oven: ASTM D 573.
d. Slip Resistance: ASTM D 2047 and E 303.
e. Tensile Strength: ASTM D 412.
f. Elongation at Break: ASTM D 412.
g. Tear Strength: ASTM D 624.
h. Peak Load: ASTM D 624.
i. Density: ASTM D 3676.
j. Taber Abrasion: ASTM C 501.
k. Flammability: ASTM D 2859.
7. Certificate of Compliance: Submit manufacturer's certificate of compliance indicating materials comply with specified requirements.

B. Contract Closeout Submittals: Comply with requirements of Section 01 7700.
1. Maintenance data in accordance with requirements of Section 01 7820. Include detailed re-ordering information to enable Owner to match installed material exactly.

1.4 QUALITY ASSURANCE

A. Maintain one copy of the latest edition of ASTM F1487 and CPSC Pub. No. 325 at project site.

B. Manufacturer's Qualifications: Manufacturer shall meet a minimum of 1 of the following 2 requirements.
1. Continuously engaged in manufacturing of playground safety surfacing tiles of similar type to that specified, with a minimum of 10 years successful experience.

2. Furnished a minimum of 15,000,000 square feet of playground safety surfacing tiles of similar type to that specified.

C. Installer Qualifications: Company certified by manufacturer for training and experience installing the protective surfacing tiles approved; provide installer's company name and address, and training and experience certificate.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage:
1. Store materials in accordance with manufacturer's instructions.
2. Playground Safety Surfacing Tiles:
a. Store tiles in a dry area at a minimum temperature of 50 degrees F (10 degrees C) for a minimum of 72 hours before installation.
b. Protect tiles from direct sunlight before installation.
3. Adhesive: Store adhesive in a dry area at a minimum temperature of 50 degrees F (10 degrees C).

C. Handling: Protect materials during handling and installation to prevent damage.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Tile Temperature: Ensure surface temperature of playground safety surfacing tiles is a minimum of 50 degrees F (10 degrees C) at time of installation.

B. Air Temperature: Ensure air temperature is a minimum of 40 degrees F (4 degrees C) for a minimum of 24 hours before and during installation.

C. Tile or Air Temperatures: Consult manufacturer's installation instructions for modified installation procedure when tile or air temperatures are above 85 degrees F
(29 degrees C).

1.7 SPECIAL WARRANTY

A. In addition to the warranty requirements of the Contract Documents, submit 3 original copies of the manufacturer's warranty, signed by the subcontractor/installer and the Contractor with an extended correction period of **5 years**. Warranty shall include repair/replacement defective workmanship or materials, including edge raveling, bubbling, delaminiation, peeling, and rubber degradation.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. Because the safety of the playground depends on strict conformance to the design criteria, this information is provided for Contractor's information.
1. The protective surfacing constitutes a resilient layer installed over a non-resilient layer, which is installed over the subgrade, with the top of playground equipment footings and anchorage devices covered by full depth of the resilient portion of the protective surfacing.
2. The top elevation of the protective surfacing is intended to be flush with adjacent grades.
3. Use Zone: The protective surfacing has been designed to provide acceptable impact attenuation as

defined in ASTM F 1292 for Critical Height of 5 feet.

4. High Play Activity Area: The protective surfacing has been designed to provide impact acceptable attenuation as defined in ASTM F1292 for Critical Fall Height of 8 feet.
5. Ground surface shall comply with CBC 11B-1008.2.6.1 and with ASTM F1951. It shall be inspected and maintained regularly and frequently to ensure continued compliance with ASTM F1951.

B. If deviation from specified depth is required, it is the Contractor's responsibility to make all changes required to maintain specified top elevation and required impact attenuation at no extra cost to Owner; obtain approval prior to proceeding; follow approval request procedure as specified for substitutions.

2.2 PLAYGROUND SURFACING MATERIALS

A. Tiles: duraSAFE Rubber Playground Tiles.
1. Series: Premium
2. Description: Resilient, playground safety surfacing tiles.
3. Compliance: Meet and exceed CPSC guidelines for impact attenuation.
4. Material: Compression-molded, recycled rubber and binding agents.
5. Tile Locking: Tile Locking: U-shaped male and female locking mechanism on all 4 sides of the tile (patented KROSLOCK Tile Locking System) to support tile-to-tile adhesion while ensuring tiles are held in place.
6. Top Edges: Chamfered.
7. Tile Sides: Proprietary edge-cut (glue channel) system for maximum seam adhesion.
8. Wear Layer: Premium series features an EPDM blended skin for maximum color performance and wear durability.
9. Tile Bottom: Hollow core stanchion pattern.
    a. Premium Series: Laminated EPDM Virgin rubber granules. Minimum 0.12 inch thick.

10. Manufactured Size: Premium Series Bllends: 24 3/8” X 24 3/8” +/- 1/8” Installed Size: 24.125” X 24.125”.
11. Thickness:
    a. Critical Fall Height of 3 Feet: 2.00 inches.
    b. Critical Fall Height of 4 Feet: 2.25 inches.
    c. **Critical Fall Height of 5 Feet: 2.75 inches.**
    d. Critical Fall Height of 6 Feet: 3.25 inches.
    e. Critical Fall Height of 7 Feet: 3.75 inches.
    f. **Critical Fall Height of 8 Feet: 4.25 inches.**
    g. Critical Fall Height of 9 Feet: 4.75 inches
    h. Critical Fall Height of 10 Feet: 5.00 inches.
    i. Critical Fall Height of 11 Feet: 5.25 inches.
    j. Critical Fall Height of 12 Feet: 5.25 inches.
12. Minimum Weight Each Tile:
    a. Premium Series:
        i. 2.00-Inch Thickness (3’ Fall Height): 25.00 pounds
        ii. 2.25-Inch Thickness (4’ Fall Height): 25.75 pounds.
        iii. 2.75-inch Thickness (5’ Fall Height): 27.35 pounds.
        iv. 3.25-Inch Thickness (6’ Fall Height): 29.45 pounds.
        v. 3.75-Inch Thickness (7’ Fall Height): 31.89 pounds.
        vi. 4.25-Inch Thickness (8’ Fall Height): 35.31 pounds.
        vii. 4.75-Inch Thickness (9’ Fall Height): 38.75 pounds.
        viii. 5.00-Inch Thickness (10’ Fall Height): 39.41 pounds.
        ix. 5.25-Inch Thickness (11’ Fall Height): 39.75 pounds.
        x. 5.25-Inch Thickness (12’ Fall Height): 41.43 pounds.
13. Colors: Premium Skin Series Color Blends (all blends): to be selected by Owner.
    10% Color: [Black] [Blue] [Red] [Yellow] [Green] [Light Gray] [Medium Gray]
    35% Color: [Pewter] [Ivory] [Pumpkin Spice] [Sapphire] [Shamrock] [Lava]

70% Color: [Smoke] [Aquamarine] [Forest Green] [Red Rock]
95% Color: [Sedona] [Sierra Brown] [Tuscan Red] [Denim] [Safari] [Graphite] [Sangria] [Emerald Green] [Azure]

B. Test Results:
1. Impact Attenuation, ATM F 1292:
a. G-Max Score: Less than 125.
b. Head Injury Criteria (HIC) Score: Less than 700.
2. Freeze Thaw, ASTM C 67: No deterioration.
3. Rubber Deterioration/Air Oven, ASTM D 573: No deterioration.
4. Slip Resistance:
a. ASTM E 303:
1) Dry: 51 minimum.
2) Wet: 44 minimum.
b. ASTM D 2047:
1) Premium: 0.601.
5. Tensile Strength, ASTM D 412:
a. Premium Series: 331 psi.
6. Elongation at Break, ASTM D 412:
a. Premium Series: 119 percent.
7. Tear Strength, ASTM D 624:
a. Premium Series: 16.3 kNm
8. Flammability:
a. Burning Pill, ASTM D 2859: Pass.
9. Density, ASTM D 3676:
a. Premium Series: 859 kg/m3.
10. Taber Abrasion, Wear index, ASTM C 501:
a. Premium Series: 167

2.3 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. Provide manufacturer's standard tapered transition elements to support surfacing between changes of surface grade.

C. ACCESSORIES
1. Corners:
a. Prefabricated outside and inside corners.
b. Material: Plus Series Black
2. Ramps:
a. Prefabricated Ramps: “sofRAMP”.
b. Prefabricated ADA-Compliant Ramps: “sofRAMP ADA”.
c. Material: Plus Series Black
3. Adhesive:
a. Approved and furnished by manufacturer.
b. Single-component, 100% solids, polyurethane.
c. Waterproof.

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.

B. Playground equipment installer will perform playground layout prior to installation of footings; verify correctness of layout before starting this work.

C. Verify that playground equipment and site furnishings and irrigation system located within playground area are complete.

D. Verify location of underground utilities and facilities in the playground area. Damage to underground utilities and facilities will be repaired at Contractor's expense.

E. Verify that subgrades are at proper elevations and that smooth grading is complete.

F. Verify that proper depth of surfacing is marked on base supports of playground equipment.

3.2 PREPARATION

A. Correct subgrade irregularities to ensure that required depth of protective surfacing can be installed, and subgrade elevation is in accordance with manufacturer's requirements.

B. Inside Use Zones remove all obstructions that would extend into the resilient protective surfacing.

D. Remove rocks, debris, and other similar items.

E. Prepare subsurface in accordance with manufacturer's instructions to ensure proper slope, support and drainage for playground safety surfacing tiles.

3.3 SUBBASE

A. Concrete Subsurface:

1. Concrete subsurface shall be as specified in Section 03 3000.
2. Apply light broom finish.
3. Ensure concrete is sound with no loose material or cracks over 1/8 inch wide.
4. Ensure concrete is a minimum of 10 days old.
5. Test concrete for moisture in accordance with manufacturer's instructions to ensure it has sufficiently cured and is dry.
6. Power wash existing concrete in accordance with manufacturer's instructions.

3.4 RESILIENT SURFACING LAYER

A. Install in accordance with CPSC Pub. No. 325, ASTM F1487, manufacturer's instructions, and requirements of authorities having jurisdiction.

B. Install proper thickness throughout Use Zone(s).

C. Layout tile surface in accordance with manufacturer’s instructions.

D. Clean and dry surface of subbase.

E. Apply adhesive in accordance with manufacturer's instructions for tile-to-tile as well as tile-to-base for all keystone.

F. Installation to be completed by SofSurfaces certified installer.

3.5 FIELD QUALITY CONTROL

A. Installed Surface Performance Test: ASTM F1292
1. Perform impact attenuation testing according to ASTM F1292 in presence of Owner’s representative within 30 days of installation.
a. Confirm Impact Attenuation Performance of Surfacing Tiles:
1) g-max Score: Less than 125
2) Head Injury Criteria (HIC) Score: Less than 700
2. Test Equipment Operator Qualifications:
a. National Recreation and Parks Association/National Playground Safety Institute (NRPA/NPSI), Certified Playground Safety Inspector (CPSI).
b. Trained in the proper operation of Triax test equipment by competent agency.

3.5 CLEANING AND PROTECTION

A. Restore adjacent existing areas that have been damaged from the construction.

B. Clean playground equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation. Clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.

C. Clean playground area of excess construction materials, debris, and waste.

D. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.

E. Protect installed products until Owner occupancy.

END OF SECTION 32 1810

SECTION 32 3110 - GATE OPERATOR AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Pre-wired, self-contained, slide gate operator for horizontal sliding gates, including all selected attachments and accessory equipment.

B. Related Sections: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions: Supplementary Conditions, and Sections in Division l of these Specifications.
1. Section 26 6000: Basic Material and Methods (Electrical service and connections)
2. Section 32 3125: Ornamental Iron Fencing.

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Instructions: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings showing layouts, elevations, connections, and gate hardware.

1.3 QUALITY ASSURANCE

A. Installer: A minimum of three years experience installing similar equipment, provide proof of attending a manufacture’s factory training within the previous three years, or obtain other significant manufacturer endorsement of technical aptitude, if required during the submittal process.

1.4 CODES AND REGULATORY REQUIREMENTS

A. Operators shall be built to UL 325 standards and be listed by a testing laboratory. Complete all electrical work according to local and National Electrical code. All field work shall be performed in a neat and professional manner, completed to journeyman standards.

B. Current safety standards require the use of multiple external sensors to be capable of reversing the gate in either direction upon sensing an obstruction.

C. Vehicle gates should never be used by pedestrians. Separate pedestrian gates must always be provided when foot traffic is present.

D. Current safety standards require gate operators to be designed and labeled for specific usage classes. Provide a product that is listed for use in all UL 325 Usage Classes I, II, III, and IV.

1.5 PRODUCT DELIVERY AND STORAGE

A. Comply with Specifications Section 01 6600 Storage and Protection.

B. Store products in the original shipping containers, covered, ventilated and protected from all weather conditions.

1.6 WARRANTY

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A. Provide a five-year manufacturer's limited warranty against all defects in materials or workmanship. Defective materials shall be replaced with comparable materials furnished by the manufacturer, at no cost to the owner. Freight, labor and other incidental costs shall be covered by the installer under separate written five-year warranty.

PART 2 - PRODUCTS

2.1 GATE OPERATORS

A. Acceptable Products:
   1. For gates up to 1,500 lbs.: LiftMaster CSL24UL Elite Series DC Commercial Slide Gate Operator.
      a. Battery backup: 208 cycles.
      b. Travel speed: 12 inches per second.
      c. Standby power: Up to 24 days.
   2. For gates 1,500 lbs. to 3,000 lbs.: LiftMaster HDSL24UL Heavy-Duty DC Commercial Slide Gate Operator.
      a. Battery backup: 45 cycles.
      b. Travel speed: 6 to 12 inches per second.
      c. Standby power: Up to 120 days.
   3. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

B. Operator Requirements:
   1. Gear driven, continuous-duty commercial slide gate operator.
   2. Meet UL 325, UL 991, ASTM F2200, and CAS C22.2 No. 247.
   3. 24 VDC motor, continuous duty type, sized for gate conditions, with soft start and soft stop operation.
   4. Integrated battery backup system.
   5. Commercial gear-driven transmission.
   6. Manual disconnect for emergency operation.
   7. Standard power: 115V/230V single phase.
   8. Locking operator cover.

2.2 OPERATION

A. Gate Control: Automatic operation at entrance and automatic operation at exit.
   1. Design: Protect against interference or damage by lightning or other electrical influence; include fuse, over-voltage protection, flash-over protection, and line filter
   2. Entry: Automatic gate electrically operated upon activation of wireless signal and insertion of coded card and/or keypad.
   3. Exit: Automatic gate electrically operated upon detection of vehicle by sensing loop buried in pavement.
   4. Safety: Activate automatic reversing switch if an obstacle is sensed in the closing motion.

B. Operator shall be gear-driven and designed for continuous-duty commercial service. Operator shall provide smooth acceleration and deceleration and shall be capable of reversing upon sensing an obstruction. Belt-driven operators shall not be permitted.

C. Standard mechanical components:
   1. Heavy-duty steel chassis.
   2. Commercial gear reducer operating in oil bath.
   3. #41 drive chain and associated hardware.

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4. Adjustable limit assemblies.
5. Manual disconnect mechanism.
6. Corrosion-resistant enclosure suitable for outdoor installation.
7. Factory-finished housing resistant to UV degradation and weather exposure.

D. Electrical components:
1. 24 VDC continuous-duty motor.
2. Integrated microprocessor control board.
3. Soft start and soft stop functionality.
4. Timer-to-close capability.
5. Surge suppression and overload protection.
6. Security+ 2.0 radio receiver technology.
7. myQ connectivity capability.
8. Event logging and diagnostic functions.
9. Battery backup system.

E. Required external sensors: Provide monitored photoelectric sensors and monitored edge sensors as required to comply with UL 325. Devices are required to protect both the leading and trailing edges of the gate. Safety devices shall be listed and approved by the operator manufacturer.

F. Control devices: Provide LiftMaster KPW250 wireless keypad and twenty LiftMaster Security+ 2.0 transmitters.

G. Signage: Provide two LiftMaster K40-3505 warning signs, one at each side of gate.

H. Keypad pedestal: LiftMaster PED42.

2.4 VEHICLE DETECTION

A. Vehicle Detection: For use in temperature range of minus 40 to 160 degrees F; to consist of detector unit in conjunction with sensing loop to activate barrier gate when vehicle enters or exits.

B. Loop Wire: 14 gage, XHWN or THWN copper; loop size as indicated on the Drawings.

C. Loop Groove Fill: Cold poured rubberized asphalt loop sealant.

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.
B. Located concrete mounting pad in accordance with approved shop drawings.

C. Make sure that the gate is operating smoothly under manual conditions before installation of gate operators. DO NOT proceed until gate panel is aligned and operates without binding.

D. Verify that electric connections are correctly located and of the correct characteristics.

3.2 INSTALLATION

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A. Install gate operator in accordance with the manufacturer's printed instructions, current at the time of installation. Coordinate locations of operators with Drawings, other trades and shop drawings.

B. Installer shall insure that the electrical service to the operator is at least 20 AMPS.

C. Cut grooves in pavement surface, install vehicle detection loops and lead-in wires, and fill grooves with loop filler.

D. Install internal electrical wiring, conduit, junction boxes, transformers, circuit breakers, and auxiliary components required.

E. Adjust system components for smooth operation.

F. Mount warning signs adjacent to gates, such that they are visible from both side of the gate.

3.3 FIELD QUALITY CONTROL

A. Test gate operator through ten full cycles and adjust the operation without binding, scraping or uneven motion. Test limit switches to proper "at rest" gate position.

B. All anchor bolts shall be fully concealed in the finish installation.

C. Architect, or architect's representative, shall complete "punch list" with installing contractor prior to final acceptance of the installation and submitted completed warranty documentation to manufacturer.

3.4 CONTINUED SERVICE AND DOCUMENTATION

A. Train owner's personnel on how to safely shut off electrical power, release and manually operate the gate. Additionally, demonstrate the general operation and maintenance of the gate operator and accessories and provide a copy of the "Installation and Reference" manual for the owner's use (a second manual is available upon request). Manual will identify parts and equipment for future procurement.

B. Fabricate with accurate angles and surfaces which are true to the required lines and levels, forming exposed connections with hairline joints, and using concealed fasteners wherever possible.

END OF SECTION 32 3110

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SECTION 32 3115 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide chain link fence system where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 03 3000: Cast-In-Place Concrete
3. Section 08 7000: Accessible Gate Hardware

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings of manufacturer's fence system.

PART 2 - PRODUCTS

2.1 GENERAL

A. Manufacturers: Shall be an active member of the Chain Link Fence Manufacturers Institute.

B. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 MATERIALS

A. Posts, Rails, and Frames: ASTM F1083 Schedule 40 hot-dipped galvanized steel pipe, welded construction, minimum yield strength of 30 ksi.

B. Wire Fabric: ASTM A 392 zinc coated steel chain link fabric.

C. Barbed Wire: Zinc-coated steel, complying with ASTM A121 Type Z Coating Class 1; 2 strands of 0.099 inch diameter wire, with 2-pointed barbs at 4 inches on center.

2.3 COATINGS

A. Hardware: Hot-dip galvanized to weight required by ASTM A153.

B. Accessories: Same finish as framing.

C. Vinyl Coating: Black color as selected over coating of 1.8 oz/sq ft galvanizing on fabric, posts, rails, gates, accessories, and related hardware.

2.4 FABRIC

A. Fabric: 2 inch diamond mesh interwoven wire, 9 gauge thick, top and bottom selvage knuckle end closed.

B. Provide fabric in one piece widths.

2.5 POSTS, RAILS, AND ASSOCIATED ITEMS

A. End, Corner, Slope, and Pull Posts: Provide at least the following minimum sizes and weights:
1. 6'-0" high and under: Pipe, 2.5" nominal, 2.875" outside diameter, 5.79 lbs. per lineal foot.
2. 8'-0" high and under: Pipe, 3" nominal, 3.500" outside diameter, 7.58 lbs. per lineal foot.
3. 12'-0" high and under: Pipe, 4" nominal, 4.500" outside diameter, 10.79 lbs. per lineal foot.

B. Line Posts: Provide minimum sizes and weights as follows:
1. 6'-0" high and under: Pipe, 2" nominal, 2.375" outside diameter, 3.65 lbs. per lineal foot.
2. 8'-0" high and under: Pipe, 3" nominal, 3.500" outside diameter, 7.58 lbs. per lineal foot.
2. 12'-0" high and under: Pipe, 4" nominal, 4.500" outside diameter, 10.79 lbs. per lineal foot.
4. For fencing taller than 12'-0" refer to the plans for post sizes.

C. Gate Posts: Provide gate posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
1. 13'-0" wide and under: Pipe, 4" nominal, 4.500" outside diameter, 10.79 lbs. per lineal foot.
2. Over 13 feet wide, and up to 18 feet wide: Pipe, 6" nominal, 6.625" outside diameter pipe, 18.97 lbs. per lineal foot.
3. Over 18 feet wide: Pipe, 8" nominal, 8.625" outside diameter pipe, 28.55 lbs per lineal foot.

D. Top Rails:
1. Pipe, 1.25" nominal, 1.660" outside diameter pipe weighing 2.27 lbs per lin ft; or
2. Provide in manufacturer's longest lengths, with expansion type couplings approximately 6" long for each joint.
3. Provide means for attaching top rail securely to each gate, corner, pull, slope, and end post.

E. Post Brace Assemblies:
1. Provide at end and gate posts, and at both sides of corner, slope, and pull posts, with the horizontal brace located at mid-height of the fabric.
2. Pipe, 1.25" nominal, 1.660" outside diameter pipe weighing 2.27 lbs per lin ft for horizontal brace.
3. 3/8" diameter rod with turnbuckle for diagonal truss.

F. Tension Wire: Provide number 7 gauge galvanized coiled spring wire at bottom of fabric.

G. Post Tops:
1. Provide steel, designed as weathertight closure cap.
2. Provide one cap for each post.
3. Provide caps with openings to permit through passage of top rail.

H. Stretcher Bars:
1. Provide one-piece lengths equal to full height of fabric, with a minimum cross-section of 3/16" x 3/4".
2. Provide one stretcher bar for each gate and end post, and two for each corner, slope, and pull post, except where fabric is woven integrally into the post.

I. Stretcher Bar Bands:
   1. Provide steel, spaced not over 15" on centers, to secure stretcher bars to end, corner, pull, slope, and gate posts.
   2. Bands may be used also with special fittings for securing rails to end, corner, pull, slope, and gate posts

2.6 GATES

A. General:
   1. Fabricate gate perimeter frames of tubular members.
   2. Provide additional horizontal and vertical members to assure proper operation of the gate, and for attachment of fabric, hardware, and accessories.
   3. Space so frame members are not more than 8 feet apart.
   4. Materials and dimension: Pipe, 1.90 outside diameter.
   5. Weight: 2.72 lbs. per lineal foot.

B. Fabrication:
   1. Assemble gate frames by welding with special malleable or pressed steel fittings and rivets for rigid connections.
   2. Use same fabric as used in the fence.
   3. Install fabric with stretcher bars at vertical edges as a minimum.
   4. Attach stretchers to gate frame at not more than 15" on centers.
   5. Attach hardware with rivets or by other means which will provide security against removal and breakage.
   6. Provide diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates where required to provide frame rigidity without sag or twist.

C. Gate Hardware: Provide following for each gate:
   1. Hinges:
      a. Pressed or forged steel, “bulldog” type hinge allowing 180 degree opening.
      b. Provide 1-1/2 pr. of hinges for each leaf over 6 feet in nominal height.
   2. Latches:
      a. Provide forked type or plunger-bar type to permit operation from either side of the gate.
      b. Provide padlock eye as integral part of latch.
      c. Delete any cane bolts or padlocks and provide panic hardware and other accessible hardware for all gates in exit discharge or accessible routes.
   3. Keeper: Provide keeper for vehicle gates, which automatically engages the gate leaf and holds it in the open position until manually released.
   4. Double gates:
      a. Provide gate stops for double gates consisting of mushroom or flush plate, with anchors.
      b. Set in concrete to engage the center drop rod or plunger bar.
      c. Provide locking device and padlock eyes as an integral part of the latch, requiring one padlock for locking both gate leaves.
   5. Rolling gates: Provide manufacturer's standard heavy-duty inverted channel track, ball-bearing hanger sheaves, dual rubber wheels, overhead framing and supports, guides, stays, bracing, hardware, and accessories as required.
   6. Accessible Gates: Comply with CBC 11B-404.2.10.
      a. Kick Plates: 10" high x full width kickplate, secure to chain link mesh on both sides of accessible gates. The cavity created by added kickplates shall be capped.
      b. Hinges: Locinox Mammoth 180-Silver hydraulic gate closer and hinge or equivalent equal.
      c. Lever Hardware: Refer to specification section 08 7000.

   7. Required Exit Gates: Comply with CBC 1010.1 and CBC 11B-404.2.10.
      a. Panic Hardware and Trim: Refer to specification section 08 7000.

2.7 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Wire Ties:
   1. Fabric to Line Posts: 9 gauge wire ties spaced 12" on centers.
   2. Fabric to Rails and Braces: 9 gauge wire ties spaced 24" on centers.
   3. Fabric to Tension Wire: 11 gauge hog rings spaced 24" on centers.
   4. Manufacturer's standard wire ties will be acceptable if of equal strength and durability.
B. Concrete: Comply with provisions of Section 03 3000 for 2500 psi concrete.

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 INSTALLATION

A. General:
   1. Install posts at a maximum spacing of 10 feet on centers.
   2. Install corner or slope posts where changes in line or grade exceed a 30 degree deflection.
   3. Provide and install fencing, posts, fabric and accessories in accordance with industry standards.
   4. Do not, in any case, install fabric or accessories in less than 7 days after placement of concrete.
   5. **Chain link fabric shall not exceed the top rail by more than ½".**
   6. Adjust accessible gates to open with not more than 5.0 lbs. pressure, as allowed per California Building Code, Section 11B-404.2.9.

B. Excavation:
   1. Drill holes for post footings in firm, undisturbed or compacted soil, strictly adhering to the dimensions and spacing shown.
   2. Post hole dimensions:
      a. Provide as indicated in the plans. Provide 36" deep by 12" diameter foundations for all other posts.
   3. Spread soil from excavations uniformly adjacent to the fence line, or on adjacent areas of the site if so directed.
   4. When solid rock is encountered near the surface, drill into rock at least 12" for line posts and at least 18" for end, pull, gate, and corner posts. Drill hole at least 1" greater diameter than the largest dimension of the post to be placed.
   5. If solid rock is below soil overburden, drill to full depth required, except penetration into rock need not exceed minimum depths specified above.

C. Miscellaneous:
   1. Use U-shaped tie wires, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns.
   2. Bend ends of wire to minimize hazards to persons and clothing.
   3. Fasteners:
      a. Install nuts for tension band and hardware bolts on side of fence opposite fabric side.
      b. Peen the ends of bolts to prevent removal of nuts.
   4. Repair coatings damaged in the shop or field erection, using a hot-applied repair compound applied in accordance with its manufacturer's recommendations as approved by the Architect.

D. Baseball Diamond Backstops:
   1. 16'-0" high fencing: Provide top, middle, and bottom horizontal rails, and additional horizontal rail at +36".
   2. 24'-0" high fencing: Provide top, 2 middle, and bottom horizontal rails, and additional horizontal rail at +36".

END OF SECTION 32 3115

SECTION 32 3125 - DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide bolted decorative fencing system where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Section 08 7000: Accessible Gate Hardware

1.2 SUBMITTALS

A. Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements.
2. Installation Instructions: Submit manufacturer's recommended installation procedures.
3. Shop Drawings: Submit shop drawings indicating plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: The fence system shall conform to Montage II ***Welded and Rackable*** (ATF – All Terrain Flexibility) Ornamental Steel, Majestic design, (1) bottom rail with extended picket treatment, (2) top rails with no pickets above top rail, manufactured by Ameristar Fence Products, Inc., in Tulsa, Oklahoma, (800) 321-8724.
1. Products specified are for establishing the type, design, and quality required. Products of equal or better type, design, and quality produced by other manufacturers will be considered provided the request for substitution is submitted in accordance with Section 01 2500.

2.2 FENCES

A. Fence System: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and cable of resisting vertical load, horizontal load and infill performance requirements for fence categories defined in ASTM F2408.

B. Steel Materials: ASTM A653; tensile strength 45,000 psi, minimum; hot-dip galvanized; A 653, G60.

C. Fasteners: ASTM A276, Type 302 stainless steel; finished to match fence components.
1. Tamper-proof security bolts.
2. Self-drilling hex-head screws.

2.3 MECHANICALLY FASTENED STEEL FENCE

A. Provide fence meeting requirements for Industrial class as defined by ASTM F2408.

B. Fence Panels: Mechanically fastened with internal reinforcement and tamperproof fasteners; 7'-0" high by

nominal 8'-0" long.
1. Panel Style: Three rail.
2. Panel Strength: Capable of supporting 400 pound load applied at midspan without deflection.
3. Attach panels to posts with manufacturer's standard panel brackets.

C. Posts: Steel tube; size as indicated on the Drawings, with manufacturer's standard cap.

D. Rails: Manufacturer's standard, double-wall steel channel; 1.75"x1.75"x.105" with pre-punched picket holes.
1. Picket Retaining Rods: 0.125" galvanized steel.
2. Picket-to-Rail Intersection Seals: Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by Ameristar's proprietary fusion welding process, thus completing the rigid panel assembly.

E. Pickets: Steel tube; 1" square by 14 gauge.
1. Spacing: 4.175" on center.
2. Style: Flush top rail.

F. Flexibility: Capable of following variable slope of up to 1:4.

G. Perforated Metal: McNichols, item number 1431141841 or approved equal. Round Hole, Galvanized G90, 18 Gauge, Mill Finish, 3/16" Holes on 1/4" Centers, Staggered Pattern, 51% Open Area.

2.4 STEEL GATES

A. Swing Gates:
1. Gate shall be same cross section as the fence rails and pickets.
2. Gate frames shall be welded with stainless steel rods and capable of proper operation as related to the operable span.
3. All rail and upright intersections shall be joined by welding.
4. All picket and rail intersections shall also be joined by welding.
5. All gate uprights shall be 2"square by 11 ga.
6. Gates that exceed 6' in width will have a 1.75" sq. x 14ga. intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding. Gusset plates will be welded at each upright to rail intersection.

B. Sliding Gates:
1. Gate shall be same cross section as the fence rails and pickets.
2. Sliding gates shall be cantilevered aluminum construction capable of proper operation as related to the operable span.
3. All rail and upright intersections shall be joined by welding.
4. All picket and rail intersections shall also be joined by welding.

C. Gate Hardware:
1. Hinges: Roller bearing hinge, 4", item #KIHDSSH3B by Kodiak Iron.
2. Latches:
a. At single leaf gates provide 13 gauge welded lock box with integral strike to accept a double keyed deadbolt (2-3/4" backset), LH275 by Jansen Ornamental Supply Co., 800-423-4494. Finish lock box to match fencing. Weld lock box to gate leaf; provide fabricated hole in gate post for dead bolt strike plate.
b. At double leaf gates provide 48" long heavy-duty drop rods on each gate leaf, with strong arm gate latch (pad lockable) on one leaf.
3. Accessible Gates: Comply with CBC 11B-404.2.10.

a. Kick Plates: 10" high x 3/16” thick steel plate x full width kick plate, secure to the gate panel on both sides of accessible gates. The cavity created by added kickplates shall be capped.
b. Hinges: Locinox Mammoth 180-Silver hydraulic gate closer and hinge or equivalent equal.
c. Lever Hardware: Refer to specification section 08 7000.

4. Required Exit Gates: Comply with CBC 1010.1 and 11B-404.2.10.
   a. Panic Hardware and Trim: Refer to specification section 08 7000.

2.5 FABRICATION

A. Except as otherwise shown on the Drawings or the approved Shop Drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.

B. Fabricate with accurate angles and surfaces which are true to the required lines and levels, forming exposed connections with hairline joints, and using concealed fasteners wherever possible.

C. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.

D. Insert retaining rods into each rail so that they pass through the pre-drilled holes in each picket, thus completing the panel assembly.

E. All corner joints shall be miter cut, welded and ground smooth. Where two dissimilar sizes join, all exposed ends of tube or pipe steel shall have caps provided of same thickness steel plate, weld and grind smooth.

F. Gates:
1. Provide frames of sufficient size and thickness to provide adequate support without sag.
2. Frames larger than 8'-0" in length shall include an additional bottom rail support at mid-span capable of accepting a wall support mounted as a foot and bolted to a concrete mowstrip similar to pilaster anchorage.
3. Pickets shall be of the same size and style as those in the fence panels.

2.6 FINISHES

A. Electro-Deposition Coating: Multi-stage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
1. Total Coating Thickness: 2 mils, minimum.
2. Color: As selected by Architect from manufacturer's standard range.
3. Coating Performance: Comply with general requirements of ASTM F2408.
   a. Adhesion: ASTM D3359 (Method B); Class 3B with 90 percent or more of coating remaining in tested area.
   b. Corrosion Resistance: ASTM B117, D714 and D1654; 1/8 inch coating loss or medium No.8 blisters after 1,500 hours.
   c. Impact Resistance: ASTM D2794; 60 inch pounds.
   d. Weathering Resistance: ASTM D523, D822/D822M and D2244; less than 60 percent loss of gloss.

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 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

A. General:
   1. Set work accurately into position, plumb, level, true, and free from rack.
   2. Anchor firmly into position.

B. Gates:
   1. Install plumb and level.
   2. Lubricate all hinges, rollers, and other gate hardware after installation.
   3. Adjust accessible gates to open with not more than 5.0 lbs. pressure, as allowed per California Building Code, Section 11B-404.2.9.

C. Touch up scratched surfaces using materials recommended by manufacturer. Match touchup paint color to fence finish.

END OF SECTION 32 3125

SECTION 32 8400 – LANDSCAPE IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all materials, labor, equipment and services necessary to furnish and install Landscape Irrigation System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded. The extent of the underground landscape irrigation system is shown on the drawings. The Contractor shall carefully review the plans and specifications and if they feel that more equipment is needed, they shall include that in the bid. All extra work to achieve full coverage shall be at the Contractors expense. Sprinkler systems shall be complete, operative and automatic and provide full coverage of the planted areas.

B. Irrigation systems shall be constructed to the sizes, grades and locations shown on the plans. Irrigation pipelines shown on the plans are essentially diagrammatic. Locations of all irrigation improvements shall be established by the Contractor at the time of construction. Typical spacing of the sprinklers are shown on the plans and shall not be exceeded, except by written permission of the Owner's authorized representative.

C. The system has been designed to a pressure as indicated in these specifications. The Contractor shall test the mainline prior to starting any work and verify that such pressure does exist. If it does not, the Contractor shall notify the Owner at once for a ruling before starting work. If the Contractor does not test prior to starting work, all corrective work shall be at the Contractors expense.

1.2 RELATED SPECIFICATION SECTIONS

Division 31	EARTHWORK
32 9000	LANDSCAPE CONSTRUCTION
Division 03	CONCRETE
Division 26	ELECTRICAL

1.3 STANDARDS

A. Materials and installation shall conform to all State and Local codes and regulations governing the trades included in this work. Requirements of these plans and specifications not conforming therewith, but exceeding code requirements, then the plans and specifications shall govern.

1.4 EXPLANATION AND EXAMINATION OF SPECIFICATIONS AND PLANS

A. Due to the scale of the Drawings, it is not possible to indicate offsets, fittings, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of their work and plan their work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed in the most direct and workmanlike manner so that conflicts between irrigation systems, planting, utilities, and architectural features will be avoided.

B. Notes on Drawings: Work called for on the Drawings by notes shall be furnished and installed whether or not specifically mentioned in the Specifications.

C. It shall be the responsibility of the Contractor to carefully examine the site, plans and specifications relating to this work for completeness, accuracy and clarity. Any conflict, error, or clarification shall be immediately brought to the attention of the Owner's authorized representative in writing to obtain a ruling. Failure to do so prior to bidding shall result in any corrective work necessary shall be completed at the Contractor's expense.

D. It is the intent of these specifications and plans to form a guide to accomplish the work of installing a complete sprinkler system which will operate in an efficient and satisfactory manner according to the workmanlike standards established for the irrigation industry. Therefore, any items not specifically noted, but necessary for a complete installation, shall be furnished and installed under this contract.

E. Manufacturer printed instructions shall also be a part of these specifications and shall prevail over these specifications. The Contractor shall be responsible to provide such details and instructions to the inspecting person for approval or rulings.

F. All general and specific notes shown on the drawings and details herein shall take precedence over these specifications. All work designated on the drawings by notes shall be furnished and installed.

1.5 PERMITS AND INSPECTIONS

A. The Contractor shall obtain and pay required fees to any governmental or public agency. Permits for the installation or construction of the work included under this Contract, which are required by legally constituted authorities having jurisdiction, shall be obtained and paid for by the Contractor, each at the proper time. The Contractor shall also arrange for and pay costs in connection with inspections and examination required by these authorities.

1.6 GUARANTEE

A. Irrigation system shall be guaranteed for a period of one year from the date of final acceptance. Any repairs required are to be completed by the Contractor in a timely manner at no additional cost to the Owner.

1.7 OPERATIONS AND MAINTENANCE INSTRUCTIONS / RECORD DOCUMENTS

A. Two copies of equipment operations, maintenance instructions, and wire diagrams shall be furnished to the Owner prior to final acceptance. Two copies of control valve station charts (color coded reduced Irrigation Plan with plastic waterproof lamination) showing watering zones and stationing shall be provided and mounted in the controller pedestal.

B. The Contractor shall furnish one set of reproducible Record Documents (As-Built drawings) in form of 24 lb bright white bond paper and electronic PDF file.

1. Label first page of each document, or set of documents, "RECORD DRAWINGS" in neat large printed letters on lower right hand corner. Record information concurrently with construction progress. Do not conceal any work until required information is recorded on a daily basis.

2. Drawings: Legibly mark to record actual construction:
   a. Horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements. Give sufficient horizontal and vertical dimensions to accurately trace route and invert of each concealed line or item. Accurately locate each capped, plugged, or stubbed line.
   b. Field changes of dimension and detail.

c. Changes made by Field Order, by Addenda, or by Change Order.
d. Details not on original Contract Drawings.

3. Deliver all Record Documents (As-Builts) to Landscape Architect. Accompany submittal with transmittal letter in duplicate, containing:
   a. Date.
   b. Project title.
   c. Contractor's name and address.
   d. Title and number of each Record Document (As-Built).
   e. Signature of Contractor or his authorized representative.

1.8 SUBMITTALS

A. Within the required time period stated in the General Provisions, the Contractor shall submit six (6) copies of complete lists of proposed materials to Landscape Architect including manufacturer's name and catalog numbers.

B. Shop drawings shall follow (six copies) for equipment including dimensions, capacities, and other characteristics listed in product specifications. Materials and equipment shall not be ordered until given written approval by Landscape Architect.

1.9 DEFINITIONS

A. Piping: All pipe fittings, valves, and accessories as required for a complete piping system.

B. PVC: Polyvinyl Chloride.

C. Agencies and Organizations:

1.	ASTM	American Society for Testing and Materials
2.	AWWA	American Water Works Association
3.	IAPMO	International Association of Plumbing and Mechanical Officials
4.	CEC	California Electrical Code
5.	UL	Underwriter's Laboratories

1.10 UNDERGROUND OBSTRUCTION

A. The Contractor shall verify all underground obstructions, and / or utilities, existing or proposed, prior to trenching. Contractor shall avail themselves of any “as built” drawings of the site, Underground Service Alert (USA) 1-800-227-2600 and records of existing and proposed site work. This shall also include verifying between proposed irrigation work and existing / proposed underground utilities. Contractor shall call for a ruling by the Owner’s Authorized Representative prior to work to obtain a ruling in the event of a conflict.

B. The Contractor, after availing themselves to the existing record drawings, Underground Service Alert and coordination with other trades installing underground utilities and excavation operations incurs and damages any existing utility not identified, the Contractor shall stop work and notify the inspector on site, obtain a ruling and repair the damage.

1.11 WORKMANSHIP

A. The Contractor shall have experience and demonstrated ability in the installation of irrigation systems of this type. No work shall be completed without supervision. All work shall be installed by skilled persons proficient in the trades required, in a neat, orderly and organized manner, with the recognized standards of craftsmanship developed for the industry and as described in the plans, specifications and manufacturers installation instructions.

1.12 PROTECTION TO THE PUBLIC HEALTH AND WELFARE

A. The Contractor in the course of their work shall make every effort to guard the public health, safety and welfare during construction. This shall include erection of barricades, night warning lights and all necessary devices required to protect the public health and welfare or as required by existing governmental codes. The Contractor shall accept any and all liabilities arising from accident or injury on the job and after construction. All equipment which protrudes above grade shall be installed against a structure or an appropriate barricade shall be erected to protect public safety.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials and equipment to be used shall be as outlined on the irrigation legend, or as described in the irrigation notes and irrigation specifications. All materials shall be new and unused.

B. All specified materials, products and manufacturers are relevant to describe the required quality and features of a particular component of the irrigation system, however, the specific product or manufacturer noted is to be construed to be followed by the words, “or approved equal”.

2.2 PIPELINES / SLEEVES

A. Irrigation Piping:

1. 2" thru 3": Pressure pipe / upstream of control valve (mainline pipe): PVC Schedule 40 solvent weld pipe, PVC Material ASTM D1784, Cell Class 12454B, Pipe Design ASTM D1785 & compliance with all NSF & IAPMO (UPC) requirements.

2. 4” thru 6”: Pressure pipe / upstream of control valve (mainline pipe): PVC Class 200 gasketed pipe, pressure rating 200 psi, SDR 21, PVC Material ASTM D1784, Cell Class 12454B, Pipe Design ASTM D2241 & Gasket Material ASTM F477.

3. 1" thru 2 1/2": Circuit pipe / downstream of control valve (lateral pipe): PVC Class 200 solvent weld pipe, pressure rating 200 psi, SDR 21, PVC Material ASTM D1784, Cell Class 12454B & Pipe Design – SDR Pipe ASTM D2241.

4. 2" and larger: Sleeving under hardscape / paving: PVC Schedule 40 solvent weld pipe, pressure rating varies, PVC Material ASTM D1784, Cell Class 12454B & Pipe Design ASTM D1785.

5. Pipe shall be continuously and permanently marked with the following information: Manufacturer's name or trademark, nominal pipe size, schedule and type of pipe, pressure rating in PSI and (NSF, IAPMO & AWWA) seals of approval.

B. Plastic pipe shall be as called for on the plan and extruded from PVC 1120/1220 and shall meet commercial standards CS 256-63. Class and schedule of pipe shall be as called for in the plans. Strict conformance with the manufacturers recommended installation instructions is required. Painted galvanized steel (schedule 40), threaded bronze nipples, copper or painted ductile iron pipe is to be used for any pipe installed above grade. Fittings for above grade piping are to be consistent with pipeline material. Sun burned pipe or pipe that has been abused in shipping and handling is not to be used.

C. The Contractor is to install concrete thrust blocks as outlined in the thrust block detail and as recommended by the pipe & fitting manufacturers to secure all changes in direction or dead ends of all mainline pipe. The Contractor is to use rebar as needed if necessary to insure the stability of the pipe. Where concrete thrust blocks cannot be installed against continuous native subgrade, the Contractor is to install ductile iron mechanical joint restraints. No bending, or curving of pipe will be allowed, except as permitted by the pipe manufacturer. Pipe manufacturer must be approved prior to ordering materials.

D. Where piping on the plans is shown under paved areas, but is running parallel and adjacent to planted areas, the intent of the plans is to install the piping in the planted area. PVC Schedule 40 sleeves are to be used with all pipe and wire installed under hardscaped surfaces over six feet (6'-0") wide or wider.

E. Where pipeline routing changes occur in the field, the Contractor is to size the pipe so that a flow velocity of 5.0 feet per second is NOT exceeded. The minimum pipe size is 1" and 11/4" pipe is not used due to its limited flow range. The following is a basic guide for sizing lateral pipes in the field:

1. 3/4" Pipe – Not Used

2. 1" Pipe - 0 gpm thru 16.0 gpm

3. 1 1/2" Pipe - 16.1 gpm thru 36.0 gpm

4. 2" Pipe - 36.1 gpm thru 50.0 gpm

6. 2 1/2" Pipe - 50.1 gpm thru 80 gpm

7. 3” Pipe – 80.1 gpm thru 100.0 gpm

2.3 PIPELINE FITTINGS

A. Fittings:

1. For PVC solvent weld plastic pipe, 2" thru 3" mainline fittings: PVC Schedule 80 socket fittings (ASTM A2564, D2466, D2464 & D2467), Type 1, Grade 1. All mainline fittings are to be PVC Schedule 80 type with solvent weld or threaded connections.

2. For PVC Class 200 mainline pipe, 4” thr 6” mainline fittings: Ductile iron mechanical joint fittings with joint restraints as manufactured by MegaLug, LEEMCO, or approved equal. See manufacturer’s instructions and recommendations. No angular deflection of mainline pipe at the fitting bell end is allowed. For automatic valve connections to large mainline (4” thru 6”) pipe, Romac 202N ductile iron service saddle with double stainless steel straps may be used.

3. For PVC solvent weld plastic pipe, 1" thru 21/2" lateral fittings: PVC Schedule 40 socket fittings (ASTM A2564, D2466, D2464 & D2467), Type 1, Grade 1. All lateral fittings (downstream remote control valve) not specifically noted as PVC Schedule 80 type in the specifications or irrigation details are to be PVC schedule 40 type with solvent weld or threaded connections.

4. For connections between mainlines and remote control valves: Schedule 80 PVC TOE nipples and nipples (threaded both ends), see Irrigation Details.
Do not use PVC male adaptors.

5. When connection is plastic to metal, Schedule 80 TOE nipple shall be used.

6. Teflon tape shall be used on all small diameter (½" to 3") threaded connections. No liquid or paste pipe thread sealants are allowed.

B. Risers to irrigation heads: Shall be as noted on Irrigation Details.

C. Solvent Weld Adhesive: Weld-On cement & primer appropriate for size & type of pipe and fittings. See manufacturer's instructions and recommendations. Note weather and temperature limitations for use. Use primer for all joints, mainline and lateral pipe connections.

2.4 VALVES / CONTROL WIRE

A. Automatic Control Valves: Globe / Angle valves operated by low-power solenoid, normally closed, with manual flow adjustment. Sizes and types as shown on drawings. Low voltage electrical connections to valves shall have a minimum 24" coiled loop to each valve in valve box, see details. Valves shall be installed in a heavy duty plastic valve box with bolt down lid. Install one valve per valve box, no exceptions. Remote control valves are to have a solenoid that is compatible with Baseline two-wire / decoder system.

B. Two-Wire Communication Cable: Baseline biline 14-2 as manufactured by Paige #7072D Black & Red, or approved equal. Two-wire communication cable is to be installed in 1 1/2" PVC electrical conduit with long sweep ells into and exiting each valve box. Two-wire communication cable is to have a junction / pull box installed at all changes in direction and at a maximum of 150 ft apart for longer straight runs. Two-wire communication cable is to be a minimum of 18" below grade.

C. Two-wire Splices / Connectors: All wire splices / connectors to be 3M DBY-6 / DBR-6 waterproof splice kits and spare wire ends. All splices are to be located in a valve box and no direct bury splices are allowed.

D. Control Wire Marking: T. Christy Enterprise, Inc. Waterproof Irrigation I.D. Tag or approved equal (714) 771-4172.

E. Control Valve Boxes: Christy heavy duty plastic valve boxes with heavy duty bolt down lids, or approved equal. See Irrigation Details for model numbers and sizes.

F. Control Valve Box Marking: Heat imprinted or engraved with appropriate controller and station number.

2.5 IRRIGATION HEADS

A. Spray Head: Molded plastic body with plastic nozzles. Refer to schedule on drawings. Manufacturer's numbers are listed with description.

B. Rotor Head: Molded plastic and stainless steel construction. Gear driven with lockable arc adjustment and matched precipitation rate nozzles. Refer to schedule on drawings. Manufacturer's numbers are listed with description.

C. Irrigation heads adjacent to concrete walks, mow strips or other paved areas shall be offset 3" to permit edging without damage to irrigation equipment. Irrigation heads are to be set at grade. Irrigation heads are to be adjusted so that no spray hits buildings, fences, walls, or hardscaped surfaces. Install anti-drain check valves under all irrigation heads that weep or show drainage after operation.

2.6 GATE VALVES

A. 1" thru 3" Size, if required: Class 125 bronze gate valve, 200 psi WOG, manufactured domestically made of cast bronze material and cross handle with non rising stem as manufactured by NIBCO, or approved equal. Solid wedge with screw in bonnet gate valve with threaded connections resistant to dezincification.

B. 4" thru 6” Size, if required: Resilient seat ductile iron gasketed joint gate valve rated for a minimum of 200 psi, manufactured domestically by NIBCO, Waterous or approved equal.

2.7 QUICK COUPLER VALVES

A. Two piece valve with heavy duty brass construction with vinyl cover and single lug operation. Contractor is to supply Owner with three (3) quick coupler keys and three (3) hose swivels. See Irrigation Legend and Details for detailed descriptions.

2.8 CENTRAL CONTROL SYSTEM

A. Contractor is to provide data collection, data entry, programming and setup as required to for the Baseline online system (Base Manager Plus) and is to provide one (1) 10 year subscription to Base Manager Plus for the District for a total of eleven (11) years paid access. Contractor is to provide all setup and changes required for Et control of the irrigation system with online weather data. Contractor is to follow all Baseline requirements and be Baseline certified prior to starting work and have system installation certified by an authorized Baseline representative for the 10 year extended warranty.

2.9 HAND HELD RADIO SYSTEM

A. Not required for this project.

2.10 FIELD SATELLITE CONTROLLER

A. Irrigation controller is to be as specified on the plan. The installation shall be in accordance with the manufacturers instructions and recommendations. All electrical connections to the controller shall be the responsibility of the Contractor and shall be UL approved and meet all applicable codes and regulations. All wiring from the electrical source to controller shall be installed in UL approved electrical conduit.

2.11 IRRIGATION BOOSTER PUMP STATION

A. Contractor is to supply and install a Watertronics skid mounted booster pump station capable of supplying 400 gpm with 60 psi boost and a constant discharge pressure set point of 75 psi. Set point is to be adjustable within 10 – 15 psi higher or lower than 75 psi. The pump station is to feature VFD pressure regulation and have a marine grade aluminum enclosure with inlet and discharge drop pipes supplied by the manufacturer. Contractor is to install a 8” thick concrete

base with #4 rebar installed in a 12” square grid. Contractor is to fasten the pump station skid to the concrete slab per the manufacturers recommendations. Contractor is responsible for all electrical connections and other appurtenances required for a complete and operational installation. See Irrigation Legend and Details for additional information.

B. Pump station has a long lead time and Contractor is responsible to submit product submittals and order the pump station in a timely manner to insure installation within the time constraints of the project. Typical lead time is eight weeks from the date of order with retainer to the time of delivery.

2.12 VALVE BOXES

A. All valves, manual or automatic shall have a valve box, set flush with grade. All valve boxes shall be of heavy duty plastic construction with heavy duty bolt down lids. Valve boxes are to be manufactured by Applied Engineering, or approved equal. Maximum of one (1) valve per valve box, no exceptions. Placement of the valves within the valve boxes shall allow for proper servicing and maintenance space, or the installation will be rejected. Valve decoders are to be mounted to Hunter Universal Decoder Stake to keep them out of the bottom of the valve box.

2.13 AIR RELIEF VALVES

A. Air relief valves shall be installed at high elevation areas of the mainline pipe and at dead end runs. Air relief valves are to be located in the field where high elevation points can be determined. Contractor is to submit a shop drawing showing the proposed installation locations for review and approval.

2.14 BACKFLOW PREVENTION DEVICES

A. Backflow prevention device is to be installed by the Site Utility Contractor. See Civil Utility plans for additional information.

2.15 OTHER MATERIALS

A. Materials not specifically indicated but necessary for proper execution of this work shall be of the first quality as selected by the Contractor subject to the acceptance of Architect.

B. All materials appearing in the legend and details of the irrigation drawings are part of this job. Contractor is responsible for installation according to drawings and details. The system shall efficiently and uniformly irrigate all areas and perform as required by these plans and specifications.

PART 3 - EXECUTION

3.1 IRRIGATION SYSTEM DESIGN

A. Irrigation system is designed for a water pressure of 15 psi at the irrigation point of connection.

B. Verify the design pressure provided at the irrigation point of connection prior to system modifications and report any discrepancies in writing to the Architect. Failure to inform the Architect of any discrepancy in design pressure seven working days prior to installation of the irrigation system shall institute the responsibility of corrective action to the Contractor, at no expense to the Owner.

3.2 IRRIGATION STAKING

A. The location of all sprinklers, valves, piping and other irrigation improvements shall be staked out by the Contractor. All staking and measurements shall be taken from permanent objects, buildings, or other permanent hardscape features including survey bench markers, and are NOT to be taken from non-permanent boundaries such as turf boundaries which are subject to modification. All measurements shall be made in feet and inches, rounding to the nearest inch. All variations from the plans are to be continuously updated on a daily basis on the record (as built) drawings. The Contractor is to present the areas staked to the Landscape Architect for review and approval prior to starting work. The Contractor is to make the adjustments in staking requested by the Landscape Architect at no additional cost to the Owner.

B. In planter areas, the Contractor is to stake the tree and shrub locations prior to layout of the irrigation system to get approval from the Landscape Architect in the field prior to trenching. Contractor is to use color coded flags to stake plant materials by variety. Landscape Architect may move plants, delete or add plants during the staking review process. Contractor is to make changes in the field and on the as built plans at no additional cost to the Owner. After the plant layout has been staked, reviewed, adjusted and approved, the Contractor is to stake the bubbler locations for each plant or tree. Bubblers are to be located within the plant water basin on the uphill side of the plant or tree. Bubblers that are too far from the plant or tree will need to be relocated within an acceptable difference. The plant or tree rootball is to have direct access to irrigation water from the intended bubbler. Sloppy or non-compliant work will be rejected.

3.3 EXCAVATION, BACKFILL

A. Trenches for irrigation pipelines and sleeves shall be excavated either by hand or machine and shall be of sufficient width to permit proper handling and installation of the pipe and fittings. The backfill shall be compacted and evened off with the adjacent soil level. Select fill material or sand shall be used if soil conditions are rocky, or have debris. No material over 3/8" shall be allowed near the pipe, 6" below it, or 6" above the pipe. Backfill shall be made early in the morning when the soil and pipe temperatures are the same. Pipe to be installed with a minimum cover of 18" for mainline pipe and 12" for lateral pipe with spray heads and 18" for lateral pipe with rotors. Backfill shall be in 6" (lifts) increments. Each (lift) increment shall be compacted as needed to prevent settlement with tamping machine. Backfill material is to be brought to the optimum moisture content prior to starting compaction operations.

B. Contractor shall compact trench fill material as required to prevent settling of trenches. Contractor is to guarantee trenches against settling for a period of one year from the date of final acceptance by the Owner. Contractor is to fill, compact and seed settled trenches during this time at no additional cost to the Owner.

C. All pipe in the same trench shall have a minimum clearance of 4" from each other. Pipelines are not to be stacked vertically in the same trench. Pipes and wires or conduit are to have a minimum clearance of 12" from each other. Final fill over trenches shall be compacted to a level grade with no depressions.

3.4 ROAD, DRIVEWAY, PARKING LOT AND SIDEWALK PIPELINE CROSSINGS

A Any pipe, wire or communication cable that crosses any hardscaped surface six feet (6'-0") or wider, shall be installed in a PVC class 200 sleeve that is a minimum of two times larger than the pipe or wire bundle being sleeved. Sleeves are to have a minimum trench cover of 18" deep. Pipelines and wires that are to be installed below existing hardscaped improvements are to be installed in a sleeve as noted above, by horizontal directional boring. No cutting and patching of any hardscaped surface will be permitted without written permission of the Owner’s

authorized representative. Newly paved areas are to be protected and preserved from construction damage. Jacking and hydraulic (water jet) driving are not permitted. The minimum sleeve size is two (2") inch. The Contractor is to verify the inside and outside diameters of pipes and wire bundles being sleeved to insure proper fit and installation. Irrigation pipelines and wires are to be installed in separate sleeves. No more than one (1) irrigation pipeline is allowed per pipe sleeve. Low voltage wires may be bundled with communication cable and installed in an appropriate size wire sleeve in conformance with CEC requirements for wires installed in conduit.

B. If approval to cut and patch a hardscaped surface has been obtained, the Contractor shall make cuts by a pavement / concrete saw or other approved means. Where any cutting or breaking of hardscaped surface work is necessary, it shall be removed and replaced by the Contractor conforming to all prevailing project specifications and requirements. Cuts are to be made along existing scoring lines or other markings to minimize negative visual aesthetics. Barriers and night lighting shall be erected to protect the public health welfare and safety. If approval to cut and patch a hardscaped surface is denied, the Contractor shall make the crossing by using horizontal directional boring. All materials and labor for all sleeves and crossings, whatever method, are to be supplied by the Contractor at no additional cost to the Owner.

C. Backfill shall be compacted to 95%. The Owner reserves the right to test such backfill. If the backfill does not meet the required 95% compaction, the Contractor shall recompact the trench. The Contractor shall pay for all additional testing until the work meets the specifications.

3.5 PIPING INSTALLATION

A. General: Support piping without strain on joints or fittings and allow for piping expansion and contraction. "Snake" pipe into trench in accordance with manufacturer's recommendations to allow for expansion. Lay on solid sub-base, uniformly sloped.

B. The Contractor shall examine all other portions of working drawing and plan trenching and pipe routing and depth so that no conflicts will arise between irrigation and any other work. Any corrective action will be the Contractor's responsibility at no further expense to the Owner. Contractor is to endeavor to route mainline pipes a minimum of fifteen feet (15’-0”) from trees and is to get permission to install mainline pipe closer in tight locations from the Owners Authorized Representative.

C. Joints:

1. PVC Solvent Weld: Pipe shall be cut square and reamed to full size. Check for assembly prior to solvent weld. Remove excess solvent. All assembly shall be in accordance with manufacturer's recommendations, including use of primer on 1" pipe or larger.

2. Steel or PVC Schedule 40 Threaded: Pipe shall be cut square and reamed to full size. Threads shall be full cut, true and tapered. Teflon tape suitable for conveyed fluid shall be applied to male thread only.

3. Open Ends: Open ends of piping shall be capped during progress to preclude foreign matter. All pipe shall be assembled free from dirt and pipe scale.

D. The Contractor shall thoroughly flush all mainline and lateral piping prior to the installation of irrigation heads. Flush entire piping system of all debris.

3.6 IRRIGATION HEAD INSTALLATION

A. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage without overspray on non-planted areas. Flush all lines prior to installation of the sprinkler heads.

3.7 CONTROL WIRE

A. Protect two-wire path by running along side mainline piping, maintain minimum 4" separation to mainline. Do not tape wire together when encased in sleeve or conduit. Minimum cover shall be 18 inches. Connect wires together at valve manifold with 3M DBY-6 / DBR-6 splice kits as required. Tag all control wire splices with approved control wire marker at splices in valve box and in controller. Install junction boxes at all changes in direction and at 150 ft for long straight runs. All 2-wire communication cable is to be installed in 1 ½" conduit with sweep ells entering and exiting all valve boxes.

3.8 CONTROL VALVE BOX MARKING

A. Imprint valve box lid by heat imprinting or engraving with appropriate controller and station number.

3.9 TESTING

A. General: Unless otherwise directed, tests shall be witnessed by a representative of the Owner. Mainlines are to be center loaded with the joints exposed. Should any joints be covered before such tests, the Contractor shall, at their expense, uncover, test, and repair the work and that of other contractors to original conditions. Leaks and defects shown by tests shall be repaired and entire work re-tested. Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the test.

B. Piping Upstream of control valves (Mainline): Maintain 100 PSI water pressure for a duration of four (4) hours. There shall be no drop in pressure during test except that due to ambient temperature changes. Perform test with control valves installed.

3.10 CONSTRUCTION OBSERVATION

A. Observation of Work:

1. Installation and operations must be approved by the Landscape Architect.

2. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval of the Landscape Architect. Any work covered prior to inspection shall be opened to view by the Contractor at their expense.

B. Construction Observation: Periodic site visits shall be required for basic operations and installations during progression of the project. Such site visits will include, but not necessarily be limited to, the following items:

1. Preconstruction meeting.

2. Staking of plant and tree locations prior to irrigation installation.

3. Staking of sprinklers and mainline routing.

4. Mainline, wiring, lateral pipes & valve manifolds prior to backfill.

5. Irrigation coverage test and rough grading.

6. Trees & plants prior to installation, still in containers.

7. Fine grading of turf areas prior to hydroseeding.

8. Substantial completion to start maintenance.

9. Final acceptance after successful maintenance period.

The Owner will pay for initial construction observation visits, however, any additional visits required due to non-compliance, incomplete work, or substandard performance will be paid by the contractor at a cost of $750.00 per extra visit.

C. Coverage Test: When the irrigation system is completed, the Contractor in the presence of the Landscape Architect shall perform a coverage test of water afforded in the planting areas. The Contractor shall furnish all materials and labor required to correct any inadequacies of coverage disclosed. The Contractor shall inform the Landscape Architect of any deviation from the plan required due to wind, planting, soil, or site conditions that bear on proper coverage. If such corrections or additions are required in the irrigation system, the Contractor shall make all adjustments and corrections without any extra cost to the Owner.

D. Completion of Work: Prior to substantial completion and the start of the maintenance period, the Contractor shall deliver to the Owner a complete set of as built drawings on 24 lbs bright white bond paper, two (2) sets of manuals covering all materials in the irrigation system with a list of local vendors, two (2) sets of all tools required to maintain system in tool boxes, three (3) quick coupler keys with hose swivels and three (3) quick coupler cover keys, two (2) gate valve operating handles, waterproof color coded controller diagrams and extra equipment listed below not installed as part of the project. Irrigation system shall be fully automatic, operable and provide full coverage of the planting areas. In judging the work, no allowance for deviation from the original plans and specifications will be made unless already approved in writing at proper time. Should it become necessary, due to developed conditions, to occupy any portion of the work before the Contract is fully completed, such occupancy shall not constitute acceptance. The Contractor will not be responsible for any damage caused by the Owner.

3.11 EXTRA IRRIGATION EQUIPMENT

A. The Contractor shall supply the following extra equipment to be installed at the direction of the Landscape Architect during the project. Each item is to include all piping, wiring, fittings, appurtenances, labor and equipment costs for a complete installation at no additional cost to the Owner. Should any items not be installed as part of the project, the remaining items are to be delivered to Owner as part of project completion documentation.

1. Five (5): Four inch pop up bubblers with nozzles.
2. Five (5): Six inch pop up sprinklers with nozzles.
3. Five (5): Hunter I-20 rotor sprinklers.
4. Five (5): Hunter I-25 rotor sprinklers.
5. One (1): 1" electric valve with line size filter.
6. One (1): 11/2" electric valve with line size filter.
7. One (1): 2" electric valves.
8. Five (5): Baseline 1 station decoders.
9. Ten (10): DBY-6 splice kits.
10. One (1): Quick coupler valve.

All work is to be in compliance with all project specifications and construction details at no additional cost to the Owner. Items not installed as part of the project are to be delivered to the Owner as part of project close out procedures (turn over items).

3.12 MAINTENANCE

A. Adjustments: Irrigation system shall be maintained and adjusted as required to provide proper coverage throughout the 120 day maintenance period. Irrigation system maintenance shall commence upon approval of substantial completion following irrigation installation, planting operations, and general site clean up. Maintenance shall be continued until final acceptance.

B. Irrigation controller shall be set during this time with Owner. Training for persons appointed by the Owner is to be completed during this time. Final acceptance of the project will NOT occur until all training of Owner's personnel is completed.

END OF SECTION 32 8400

SECTION 32 9000 – LANDSCAPE CONSTRUCTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all material, labor, equipment and services necessary to do all Landscape Construction work and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded. Work is to include, but is not limited to, the following:

1. Soil Testing
2. Clearing, Ripping and Grading
3. Cultivation, Soil Amending and Leaching
4. Furnish and Plant Plants and Trees
5. Fertilization
6. Turfgrass Installation, Sod / Hydroseed
7. Weeding
8. Staking
9. Clean-up and Maintenance

1.2 RELATED SPECIFICATION SECTIONS

Division 31	EARTHWORK
32 8400	LANDSCAPE IRRIGATION
Division 03	CONCRETE
Division 26	ELECTRICAL

1.3 STANDARDS

A. Materials and installation shall conform with all State and Local codes and regulations governing the trades included in this work. Requirements of these plans and specifications not conforming therewith, but exceeding code requirements, then the plans and specifications shall govern.

1.4 DEFINITIONS

A. The term approved shall mean by the Architect, and only in writing.

1.5 EXAMINATION OF SPECIFICATIONS, PLANS AND SITE

A. It shall be the responsibility of the Contractor to carefully examine the site, plans and specifications relating to this work for completeness, accuracy and clarity. Any conflict, error, or clarification shall be immediately brought to the attention of the Owner’s authorized representative in writing to obtain a ruling. Failure to do so prior to bidding shall result in any corrective work necessary shall be completed at the Contractor’s expense.

1.6 PERMITS AND INSPECTIONS

A. The Contractor shall obtain and pay required fees to any governmental or public agency. Permits for the installation or construction or the work included under this Contract, which are required by legally constituted authorities having jurisdiction, shall be obtained and paid for by the Contractor, each at the proper time. Contractor shall also arrange for and pay costs in connection with inspections and examination required by these authorities.

1.7 GUARANTEE

A. Guarantee shrubs, ground covers, and lawn as to growth and health for one (1) year after final acceptance by Owner. The contractor is responsible for replacement of plant materials due to theft and vandalism until final acceptance of the project by the Owner after completion of the specified maintenance period.

B. Guarantee trees to live and grow upright for a period of one (1) year after completion and final acceptance by the Owner. The contractor is responsible for replacement of trees due to theft and vandalism until final acceptance of the project by the Owner after completion of the specified maintenance period.

C. Replace plants which lose more than 30% of their original leaves within the below described time limits.

D. Remove and replace plants within 15 days of notification which fail to conform. Replace with materials as originally specified. Guarantee for replaced materials shall begin with date of replanting and shall be as previously described.

1.8 SUBMITTALS

A. Within the required time period stated, the Contractor shall submit six (6) copies of complete lists of proposed materials to Landscape Architect including source, manufacturers name and catalog numbers.

B. Materials and equipment shall not be ordered until given written approval by Landscape Architect.

C. The Contractor shall confirm availability of plant material, supplies and materials for inclusion in the submittal. If a plant is found not to be suitable or available, the Contractor is to submit a list of three to five appropriate substitutions that are available for selection by the Landscape Architect.

1.9 UNDERGROUND OBSTRUCTION

A. The Contractor shall verify all underground obstructions and / or utilities, existing or proposed prior to making landscape excavations or installing tree stakes. Contractor shall avail themselves of any as built drawings of the site, Underground Service Alert (USA) 1-800-227-2600 and records of existing and proposed site work.

B. If there is a conflict with the utilities and the planting, notify the Landscape Architect for a ruling prior to planting.

1.10 PROJECT CONDITIONS

A. No plants shall be planted in situations that show obvious poor drainage. Such situations shall be brought to the attention of the Landscape Architect and Owner’s authorized representative. Generally, the drainage problem is to be corrected prior to installing plant material.

B. All landscape areas are to be deep ripped to a depth of twelve inches (12”) below finish grade in two directions. All trees are to have 18" diameter drainage holes that are 10’ deep.

C. The Contractor shall guarantee repair of damage to any part of the premises resulting from leaks, defects in materials, equipment or workmanship. The Contractor shall be liable for any and all accidents resulting from their work, including open holes and trenches during construction.

D. During landscape construction operations keep hardscaped surfaces clean and work areas organized.

E. Landscape concrete mow strips are to be installed so that they do not conflict with site drainage or impede drainage away from buildings. Generally, a minimum 2% slope away from buildings is to be maintained for positive site drainage. Concrete mow strips are not to trap water or cause puddling.

1.11 WORKMANSHIP

A. The Contractor shall have experience and demonstrated ability in the installation of landscapes of this type. No work shall be completed without supervision by a qualified foreman. All work shall be installed by skilled persons proficient in the trades required, in a neat, orderly and organized manner, with the recognized standards of craftsmanship developed for the industry and as described in the plans, specifications and manufacturers installation instructions.

1.12 SOIL TESTING

A. An independent soil testing laboratory, Dellavalle Laboratory, contact Chad Reenders (559) 922-9299, is to test the existing soil after rough grading operations are completed with a complete fertility assay to evaluate the soils ability to maintain and support the ornamental landscaping. Samples from eight (8) locations on the site are to be taken, with two samples from each location, one at four (4") inches in depth, and the second at sixteen (16") inches in depth (sixteen samples). The soil testing laboratory is also to complete a preliminary screening for detrimental agricultural chemical residue that may be present on site, if these results are positive, notify the Owners authorized representative for a ruling. The contractor is to pay for all required soil tests and consulting time with the soil scientist for detailed recommendations to be submitted to the Owners authorized representative for evaluation.

B. After the soil amending and leaching process, if required, has been completed, the Contractor is to take additional samples from the eight (8) locations on the site, with two samples from each location, one at four (4”) inches in depth, and the second at sixteen (16”) inches in depth (sixteen samples) to evaluate the progress and effectiveness of the soil amending and leaching work. The contractor is to pay for all required soil tests and consulting time with the soil scientist for detailed recommendations to be submitted to the Owners authorized representative for evaluation.

1.13 CONSTRUCTION OBSERVATION

A. The Contractor is to coordinate construction observation site visits with the Landscape Architect during the appropriate phases of construction, or as required by the Landscape Architect. The Contractor is to schedule site visits a minimum of one week in advance at the required phases of construction. The following outlines the phases of construction which require a site visit, however it is not limited to the following construction phases:

1. Preconstruction meeting

2. Staking of plant and tree locations prior to irrigation installation.

3. Staking of sprinklers and mainline routing.

4. Mainlines, wiring, lateral pipes, & valve manifolds prior to backfill.

5. Irrigation coverage test and rough grading.

6. Trees & plants prior to installation, still in containers.

7. Fine grading of turf areas prior to sod installation.

8. Substantial completion to start maintenance.

9. Final acceptance after successful maintenance period.

The Owner will pay for initial construction observation visits, however, any additional visits required due to non-compliance, incomplete work, or substandard performance will be paid by the contractor at a cost of $750.00 per extra visit.

1.14 PROTECTION TO THE PUBLIC HEALTH AND WELFARE

A. The Contractor in the course of their work shall make every effort to guard the public health, safety and welfare during construction. This shall include erection of barricades, night warning lights and all necessary devices required to protect the public health and welfare or as required by existing governmental codes. The Contractor shall accept any and all liabilities arising from accident or injury on the job and after construction. All equipment which protrudes above grade shall be installed against a structure or an appropriate barricade shall be erected to protect public safety.

PART 2 - MATERIALS

2.1 PLANTS

A. Conform to list of plant materials on drawings. Contractor is to provide digital photos of representative example of each plant and tree type to be used and submit to Landscape Architect for review and comment. Plants and trees are also to be inspected when delivered to the site so non-conforming materials can be identified prior to planting.

B. Plants shall be the best of their kind and class, and of optimum age, and in conformance with the standards of the American Society of Nurserymen.

C. Plants shall have normal, well-developed branch systems and shall not be root or pot-bound. Do not prune or top trees prior to delivery.

D. Delivery to be made not more than 2 days prior to installation unless nursery area approved by landscape architect is established.

E. It will be the responsibility of the contractor to place material order(s) sufficiently in advance of planting to assure availability of plants in species and size specified. Substitutions for plants and trees will not be made due to lack of advance planning.

F. No substitutions will be made without approval of the Landscape Architect or authorized representative.

2.2 SOIL AMENDMENTS

A. Soil amendments (type and quantity) are to be based on the soil test results and recommendations by the soil testing laboratory. The contractor is to include the amendments outlined in part 3.03 of this Section in the bid price. Prices for the soil amendments are to be quoted as unit prices to be adjusted based upon the recommendation of the testing lab. The contractor is to pay for all required soil tests and consulting time with the soil scientist for detailed recommendations.

B. Nitrified Aged Fir Bark Humus (forest product) as supplied by Superior Soil Supplements, Hanford, California, (559) 904-3372.

C. Commercial fertilizer (15-15-15), Best Pre-plant fertilizer (6-24-24 XB), slow release fertilizer Best All Season (19-6-12) with Polyon 43.

D. Gypsum (100% purity) and Elemental Soil Sulfur (100% purity) as supplied by Superior Soil Supplements, Hanford, California, (559) 904-3372.

E. Plant fertilizer tabs: Agriform, Best-Tabs or approved equal, quantities as shown below: 1 gallon plant (2 tabs), 5 gallon plant (4 tabs), 15 gallon plant (6 tabs) & box size tree (8 tabs).

F. Global Premium Humate as supplied by Superior Soil Supplements, Hanford, California, (559) 904-3372.

G. Certificates: In addition to any certificates specified, the Contractor shall furnish a certificate with each delivery of bulk material stating the source, quantity, date, and type of material. All certificates shall be delivered to the Owners authorized representative at the time of each delivery.

H. Samples: The contractor is to submit samples of the materials to be used for inspection and approval.

2.3 ACCESSORIES

A. Tree Stakes: 2 inches by 2 inches by 10 feet long treated lodgepole or natural redwood. Use two stakes per tree. See the tree installation detail.

B. Tree Ties: flexible vinyl "Cinch-Tie", manufactured by V.I.T. Products, San Diego, California, (619) 673-1760, and distributed by Horizon Sales, Pleasanton, California, (510) 462-6602. Use a minimum of four 24" ties per tree. See the tree installation detail.

C. Tree String Trimmer Guard: polyethylene "Trim Guard", manufactured by V.I.T. Products, San Diego, California, (619) 673-1760, and distributed by Horizon Sales, Pleasanton, California, (510) 462-6602. Use one Trim Guard per tree in the lawn areas only.

D. Tree Root Barriers: All trees within ten (10'-0") feet of a hardscaped surface, perimeter fence or building are to have root barriers installed that are 24" deep by 24" wide as manufactured by Root Solutions, Inc. and distributed by Vespro Inc., San Rafael, California, (415) 434-3072. Root barriers are to be installed so each fifteen gallon tree is to have up to 20 panels and box size trees are to have additional panels as required. If the concrete is only on one side of the tree, then 10 panels (centered on the tree) are to be installed in a straight line along the concrete or boundary as recommended by the manufacturer, or if the concrete is on two sides of the tree, then install 10 panels (centered on the tree) on two sides or 20 panels are to be installed around the perimeter of the concrete. Tree root barriers are NOT to be installed in a circular pattern around the tree, if concrete is on more than two sides of the tree add panels as required.

E. Top Soil: If required, imported topsoil shall be natural, fertile, friable loam, capable of sustaining

vigorous plant growth, free of subsoil, roots, grass, excessive amount of weeds, salt, stone and foreign matter; acidity range of pH 5.5 to 7.5; containing a minimum of 4% and a maximum of 25% organic matter. Obtain approval of the Landscape Architect or Authorized representative for placement. The contractor is to submit a topsoil sample to an approved testing lab for a complete fertility assay for approval prior to importing the material on-site.

F. Import Soil: If required, imported fill dirt shall be tested with a fertility assay from Dellavalle Laboratories to certify that the fill dirt is free of salt, boron or other deleterious minerals or matter prior to delivery and placement on the site. Contractor is responsible for all remediation required for the placement of substandard fill dirt containing salt, boron or other deleterious minerals or matter that may require the installation of additional soil amendments, leaching, additional soil testing, replacement of failed plant materials to bring the non-conforming soil into compliance at the Contractors sole expense.

G. Other Materials: Materials not specifically indicated, but necessary for the proper execution of the work, shall be of first quality as selected by the Contractor subject to approval of the Landscape Architect.

2.4 WEED CONTROL

A. Methods and chemicals shall be suitable with regard to season and shall control weeds and shall be approved by all governing agencies.

B. Treatment shall not damage or impede growth of trees, shrubs, and ground covers to be planted, nor kill or damage any existing plant material specified to remain.

C. Applicator shall be a licensed State of California Agricultural Pest Control Operator, Category E, or as required by all governing agencies.

D. Contractor shall obtain required permits from County Agricultural Commissioner. Weed control treatment shall be in accordance with Federal, State of California, County and local codes and regulations, and shall be safe, not cause a health hazard, nor disrupt or inconvenience continuing business operations of the Owner and neighbors, public street, parking lot and sidewalk use or construction activities.

E. Method of treatment shall be strictly in accordance with manufacturer's recommendations.

F. Method of application and chemicals to be reviewed and approved by the Owners representative.

G. Contractor shall ascertain and insure that all planted areas are weed-free prior to planting and maintain the site weed free during construction and maintenance periods.

2.5 STABILIZED DECOMPOSED GRANITE

A. Gray decomposed granite is to be supplied by Rosenbalm Rockery, or approved equal and is to meet gradation specification as determined by ASTM C 136 methodology (Caltrans 202) with sand equivalent as determined by ASTM D 2419 methodology (Caltrans 217) and shall have a minimum of 30.

B. Naturalseal is a stabilizing organic non-toxic binder, buff in color and without a marked odor. The swell volume shall have a minimum of 35 ml/g with a minimum mucilliod content of 80 percent. The light extraneious matter shall not exceed a maximum of 20 percent with the heavy extraneous matter not exceeding 5 percent. The material shall be screened with 90 – 100 percent passing a 200 mesh sieve.

C. Decomposed granite is derived from the crushing and screening of naturally friable granite. The blending of course sand with rock dust is not an equal product. The granite is screened to include stone particles of 3/8" minus. The particles that pass the 200 screen mesh as determined by ASTM methodology shall not exceed 18 percent. The sand equivalent shall be a minimum of 30 and the R-value shall be a minimum of 70.

D. Stabilizing organic binder Naturalseal as distributed by Rosenbalm Rockery Inc. shall have a minimum swell volume of 32 ml/gm. The binder shall be incorporated with the granite fines by the use of a pug mill that includes a weight belt feeder that insures the proper ratio of binder to granite fines. Blending with the use of a bucket loader or similar is not acceptable. For pathways the binder shall be blended at the rate of 12 lbs per ton of granite fines. For parking lots or roadways the binder shall be incorporated at the rate of 14 lbs per ton.

E. For pathways, stabilized decomposed granite shall be placed to a minimum depth of 3" compacted thickness. For driveways or vehicular roadways stabilized decomposed granite shall be placed to a minimum depth of 4" compacted thickness.

F. For each 2" lift evenly spread the material over designated area. Grade and smooth as outlined on the plans. Thoroughly water entire area so that the entire depth of the material is moist. After a period of +/- 6 hours compact the final lift with a 1,000 – 3,000 lbs static drum roller. Allow for a sufficient curing period of +/- 4 days prior to use.

PART 3 - EXECUTION

3.1 SITE INSPECTION

A. Locate cables, conduit, piping, and other obstacles prior to beginning excavation. Notify Owners representative of obstacles requiring relocation.

B. Remove rocks and other similar underground obstructions to depths necessary to permit proper installation of lawns and planting.

C. Verify that landscape irrigation system has been properly installed and is fully operational.

D. Verify dimensions shown on plan and notify Owners representative of any discrepancy.

E. Review plant list and consult Owners representative with any questions or concerns.

3.2 GRADING

A. Contractor is to remove weeds and debris from site prior to starting grading operations and is to maintain the site weed free throughout the progress of construction.

B. Contractor is to work soil in a manner which does not cause excessive compaction or clods which will not break easily. Apply water as necessary to obtain optimum moisture content for tilling and planting. The Contractor is to coordinate deep ripping of all landscape areas to a depth of twelve inches (12") to break up compacted areas to improve drainage.

C. After the grades have been reestablished after irrigation trench backfill and prior to planting, the Contractor is to heavily irrigate the site to the point of producing runoff to verify that the site is free draining without puddles or low spots. Contractor is to address grading problems and repeat the test until all puddles and areas of standing water drain within one half hour (1/2 hr). Contractor is to fill settled areas as required. Planting shall not proceed until all grading corrections have been completed and the areas have been retested to confirm conformance.

D. The contractor is responsible for the grading of all planting areas. The grades shall be gently flowing with no abrupt changes. The contractor is responsible to insure that the planting areas have adequate soil and is to fill low areas as needed. The contractor is to grade the areas to drain as intended by the site grading plan by the Project Civil Engineer. Typically the planter areas are to be slightly crowned or cross sloped to insure positive drainage away from planted areas to the perimeter to drain as intended by the Site Drainage Plan. No standing water will be permitted in planter areas where plants and trees are located. Slope surfaces away from buildings at a 2% slope with no pockets of standing water. The contractor is responsible for all import or export of soil and removal of debris, trash, or other elements off site at Contractors expense to provide the Owner with a completed landscape project at no additional cost to the Owner.

E. Provide neat, smooth, and uniform finish grade. Final soil elevations in perimeter areas are to be as noted below. Grades may taper from perimeter areas over a smooth gradual transition.

1. Turf Areas: 1” below the adjacent sidewalks or other hardscape features.
2. Planter Areas: 1 1/2” to 2” below the adjacent sidewalks or other hardscape features.

F. Notify Owners representative upon completion of grading for approval and to verify the smoothness and accuracy of fine grading and clod-free condition of planting surface. No planting is to be started prior to obtaining the approval of the fine grading from the Owners authorized representative.

G. Install concrete mow strips between all turf and planter boundaries. Install the mow strips as shown in the Concrete Mow Strip Detail and as outlined in the project plans and specifications. Contractor is to insure that concrete mow strips do not interfere with site drainage and do not trap water or cause puddling.

3.3 SOIL PREPARATION

A. Soil Amendments, Cultivation and Weed Control:

1. The contractor is to cultivate the soil amendments into the top eight (8") inches of soil. The following soil amendment types and quantities are to be included in the bid. Pending the results of the soil tests, and recommendations of the soil testing laboratory, adjustments to the types and quantities of soil amendments to be used may be necessary. The contract price will be adjusted according to the actual soil amendments installed on the project. The contractor is to include the following soil amendments as part of the bid:

a. Lawn Areas:
   1) Pelletized Gypsum (100% purity) (Preplant), (4 tons per acre).
   2) Tiger 90CR Soil Sulfur (100% purity) (Preplant), (1/2 ton per acre).
   3) Best Triple Pro Fertilizer (Preplant) - (15-15-15), (500 lbs per acre).
   4) Best Preplant Fertilizer (Preplant) - (6-20-20 XB), (500 lbs per acre).
   5) Global Premium Humate (Preplant), (250 lbs per acre).
   6) Best All Season Fertilizer with Polyon 43 (Maintenance) - (19-6-12), maintenance applications and rates as follows:

      Hydroseeded Turf Areas: (130 lbs per acre) per maintenance application. Minimum of seven maintenance applications required for bid. Fertilize hydroseeded areas every other week. Actual application will conform to soil test results.

      Sodded *Turf Areas:* (200 lbs per acre) per maintenance application. Minimum of four maintenance applications required for bid. Fertilize sod areas monthly. Actual application will conform to soil test results.

7) Pelletized Gypsum, (Maintenance) - (1 tons per acre). One maintenance application required for bid. Actual application will conform to soil test results.

8) Global Premium Humate, (Maintenance) - (250 lbs per acre). One maintenance application required for bid. Actual application will conform to soil test results.

b. Planter Areas:
1) Nitrified Aged Fir Humus (forest product) (Preplant), (4 cu. yds. per 1000 sq. ft.).
2) Pelletized Gypsum (100% purity) (Preplant), (4 tons per acre).
3) Tiger 90CR Soil Sulfur (100% purity) (Preplant), (1/2 ton per acre).
4) Best Triple Pro Fertilizer (Preplant), (15-15-15), 500 lbs per acre.
5) Best Preplant Fertilizer (Preplant), (6-20-20 XB), (500 lbs per acre).
6) Global Premium Humate (Preplant), (250 lbs per acre).
7) Best All Season Fertilizer with Polyon 43 (Maintenance) - (19-6-12), maintenance applications and rates as follows:

Planter Areas: (200 lbs per acre) per maintenance application. Minimum of four maintenance applications required for bid. Fertilize planter areas monthly. Actual application will conform to soil test results.

8) Pelletized Gypsum, (Maintenance) - (1 tons per acre). One maintenance application required for bid. Actual application will conform with soil test results.

9) Global Premium Humate, (Maintenance) - (250 lbs per acre). One maintenance application required for bid. Actual application will conform to soil test results.

The Owners authorized representative and Contractor shall negotiate the differences in costs according to the materials required based upon the recommendations of the soil testing laboratory. No labor difference in cost will be allowed for application of the corrected materials to be used.

2. Soil Amending – Application #1: If salt is present in the soil test results, Contractor is to apply and incorporate the following soil amendments into the soil – Gypsum, Soil Sulfur and Nitrified Aged Fir Humus (planter areas only). Contractor is to reestablish site grades (smooth areas without displacing amendments) and leach the soils for four to six weeks.

3. Contractor is to retest the site soils as noted in 1.12 (B) above, if salt is present in the soil test results and leaching is required.

4. Soil Amending – Application #2: Contractor is to apply and incorporate the following soil amendments into the soil – Preplant Fertilizers and Humate amendments. Contractor is to reestablish site grades (smooth areas without displacing amendments) and leach the soils for one to two weeks.

5. If there are no or low salts in the soil test reports and leaching is not required, then the Contractor can combine Preplant Soil Amendment Applications #1 & #2 and delete the leaching requirement and issue a credit to the District.

6. After cultivation, water the site until the first weed crop is established. Cultivate or treat with chemicals to assure a weed-free condition.

7. Planting beds may be established after the second cultivation and final fine grading has been inspected and approved.

B. Planting holes:

1. All 15 gallon size trees or larger, are to have one 18” diameter hole drilled up to ten (10’) deep to insure proper drainage. Holes are to be off set with tree root balls “benched” into the top of the hole to prevent the tree against settlement.

2. Holes are to be excavated three times the size of the rootball. The contractor is to slightly off-set the drainage holes to prevent settling of plants after installation. The contractor is to guarantee that the trees and shrubs will not settle below grade. Trees in turf grass areas are to be planted after the stolons and sod has become established and no longer requires excessive irrigation, which may cause undue stress to the trees.

3. Holes are to be in damp (but not saturated) and friable condition with all hidden obstructions removed before planting. The backfill is to be mixed thoroughly as specified adjacent to the planting hole prior to planting.

C. Leaching: Leaching of the soils is a critical element in how fast the soils will be reclaimed. The Contractor is to expedite the irrigation installation during the early stages of the project to allow leaching operations with the irrigation system at the earliest possible time in the project schedule. The Contractor is to provide labor and materials as needed to leach soils with irrigation water in areas that will not delay the progress of other site improvements. During leaching operations, the Contractor is to maintain the soil saturated while limiting runoff. Contractor is to monitor depth of soil saturation to plan periods of drying appropriately.

Contractor is responsible for temporary measures required to retrofit the planter area irrigation system for leaching by installing spray nozzles on bubbler pop ups, installing temporary sprinklers, relocating sprinkler or other improvements required to insure good coverage of all planter areas for the purposes of leaching. Once leaching has been completed, contractor is to remove temporary improvements and restore the system to conform to the project documents.

3.4 PLANTING

A. Water plants immediately upon delivery to site. Maintain in moist condition until planted.

B. Space plants uniformly as shown on plans. The Contractor is to stake the locations of plants and tree locations prior to layout of irrigation system for review and approval by the Landscape Architect in the field prior to trenching. Contractor is to use color coded flags to stake plant materials by variety. After the plant layout has been approved, the Contractor is to stake the bubbler locations for each plant and tree. Bubblers are to be located on the uphill side of the plant within the plant basin. Landscape Architect may move, add or delete plants or trees in the field and the Contractor is to adjust the work as required at no additional cost to the District. Contractor is not to proceed with irrigation or planting operations, until the planting locations have been approved by the Landscape Architect in the field.

C. Cut cans by cutting vertically on two opposite sides of can with can cutter, or as recommended by the nursery for the type and size of containers supplied with the plant materials. Do not damage plant.

D. Plant immediately after removal from the can or flat. Position the top of the plant root ball 1" above finish grade. Backfill as follows:

1. (85%) native soil.

2. (15%) nitrified humus.

3. Azaleas and camellias are to have an additional 2 cu. ft. Camellia Mix in backfill.

4. Agriform / Best plant tabs as indicated on plans. Place plant tabs beside root ball as recommended by the fertilizer manufacturer. Construct a watering well one foot radius from stem or trunk that will allow water to fill well at least 3" deep for shrubs and two foot radius from trunk that will allow water to fill well at least 4" deep for trees. Fill water well at least six times by hand after planting.

E. Fertilize all ground cover areas with post-plant commercial slow release fertilizer 19-6-12 upon completion of planting, and every 30 days through the first growing season at a rate of 5 lbs per 1000 square feet, or as recommended by the soil test results.

F. At completion of planting, all non-turf planted areas are to receive a three inch (3") layer of topdressing mulch of shredded walk-on fir bark, Superior Walk-On Bark as supplied by Superior Soil Supplements, (559) 904-3372. Wash excess bark off leaves and do not engulf stems of plants and ground cover.

G. Turf Installation (Hydroseed):

1. The turf areas, as indicated on the plans, shall be hydroseeded in one operation after all trees, weed removal, soil preparation, grading, scalping, verticutting, compaction remediation work and irrigation system work have been completely installed, inspected and approved.

2. Hydromulch mixing shall be performed in a tank with a built-in continuous agitation and recirculation system of sufficient capacity to produce a homogeneous slurry of fiber, fertilizer, water, and additives in the specified proportion. Hydroseeding Slurry Mix:

   a. Mulch: Agrono-Mulch @ 1500 lbs per acre. As distributed by Agrono-Tec Seed Co., Fresno, California, (559) 277-2444.
   b. Binder: Agrono-Tac @ 120 lbs per acre.
      Fiber Plus @ 25 lbs per acre.
   c. Fertilizer: Soluble time release granular mixture of 24-4-8 @ 250 lbs per acre.
   d. Seed – Bermudagrass Turf: Pan Am Improved Seeded Bermudagrass (4 lbs per 1,000 sq ft) and Perennial Ryegrass (8 lbs per 1,000 sq ft) Blend. Seed at a rate of 12.0 lbs per 1,000 sq ft.

3. The final seed mix is subject to change. Verify the final approved seed mixes with the Owners authorized representative prior to seeding. The seed mix will be adjusted to account for the use, drought tolerance, and the time of year to be installed.

4. The area to be seeded shall be slightly moist after the last watering and final weeding operations. The grading must be approved prior to hydroseeding. The site must be free draining prior to hydroseeding.

5. The area to be seeded shall be hydromulched with a discharge system that will apply the slurry to the areas to be treated at a continuous, uniform rate. The tank shall have a minimum capacity of 1000 gallons. Nozzle applying the slurry shall be held close enough to the areas to be planted to distribute the slurry in a uniform coating on the surface. A green marker dye shall be used to show such coverage.

6. The turf area establishment work is to proceed as follows. Time periods noted are from the

date of hydroseed planting.

a. *Weeks 1 thru 4:* Fertilize once (week 3 or week 4) with Best 19-6-12 with polyon 43 at a rate of 3.0 lbs per 1,000 sq ft (130 lbs per acre) to keep hydroseed in a healthy growth state and mow once (week 4) with reel mower with roller (Toro 5210, or approved equal) to stimulate the lateral turf growth and increase density.
b. *Weeks 5 thru 15:* Fertilize every other week (weeks 6, 8, 10, 12 & 14) with Best 19-6-12 with polyon 43 at a rate of 3.0 lbs per 1,000 sq ft (130 lbs per acre). Mow 2 times weekly with reel mower with roller (Toro 5210, or approved equal) to stimulate the lateral turf growth and increase density. Mowing height to be 5/8" to 3/4" of an inch.
c. *Weeks 16 thru 17:* Fertilize as required to keep turfgrass in a healthy condition. Mow 1-2 times weekly with reel mower with roller (Toro 5210, or approved equal) and raise turfgrass mowing height to 1" to complete the maintenance period.

7. A minimum of one trained workman shall be on the site 2 hrs per day (minimum or as required) after hydroseeding and through the maintenance period. The hydroseeded areas shall be watered immediately and kept damp during the entire germination period. Areas that are drying out too soon due to wind or other causes shall be watered by hand until the whole grass area comes up in a uniform and even covering of grass. Care shall be used to not overwater, which would create erosion. All erosion scars are to be repaired the same day.

8. The contractor is to carefully observe the newly planted grass to keep moist and in a healthy growing condition. The contractor is to water and fertilize as needed to keep the turf in a vigorous healthy condition.

9. The contractor is to protect the newly seeded area from foot traffic as needed. The contractor is to continuously reseed and repair damaged areas. The turf areas, as indicated on the plans, shall be hydroseeded in one operation after all weed removal, soil preparation, grading and irrigation system have been completely installed and approved. Trees are to be installed after the turf has been established. Stake tree locations during turf establishment.

H. Lawn Installation (Sod):

1. The turf areas, as indicated on the plans, shall be sodded in one operation after all weed removal, soil preparation, grading and irrigation system have been completely installed and approved. Trees are to be installed after the turf has been established. Stake tree locations during turf establishment.

2. The allowable planting window for sod starts on March 1st and extends thru October 30th annually. Planting after October 30th or before March 1st is not permitted. Contractor is to schedule the work to insure that the planting is completed within this planting window. Do not plant in excessively hot weather or when unseasonably hot weather is forecast in the near future.

3. Finish grade is to be smooth and firm to prevent differential settlement. Sod is to be laid in staggered rows (brick like pattern). Edges are to be firmly butted together to insure soil to soil contact between sod pieces. Sodded areas are to be rolled (water roller) to remove air pockets and insure good soil contact.

4. The area to be sodded shall be slightly moist after the last watering and final weeding operations. The grading must be approved prior to sodding. The site must be free draining prior to sodding.

5. The turf area establishment work is to proceed as follows. Time periods noted are from the date of bermudagrass sod planting.

   a. *Weeks 1 thru 4:* Fertilize once (week 2 or week 3) with Best 19-6-12 with polyon 43 at a rate of 4.6 lbs per 1,000 sq ft (200 lbs per acre) to keep sod in a healthy growth state and mow once per week.
   b. *Weeks 5 thru 12:* Fertilize twice (weeks 7 & 12) with Best 19-6-12 with polyon 43 at a rate of 4.6 lbs per 1,000 sq ft (200 lbs per acre). Mow 1 time weekly. Mowing height to be 3/4" to 1" inches.
   c. *Weeks 13 thru 17:* Fertilize once (week 16 or week 17) to keep turfgrass in a healthy condition. Mow 1 time weekly and raise turfgrass mowing height to 1" to complete the maintenance period.

6. A minimum of one trained workman shall be on the site 2 hrs per day after sodding and through the maintenance period. The sodded areas shall be watered immediately and kept damp during the entire establishment period. Areas that are drying out too soon due to wind or other causes shall be watered by hand until the whole grass area is established in a uniform manner. Care shall be used to not overwater, which would create erosion and fungus. All erosion scars are to be repaired the same day.

7. The contractor is to carefully observe the newly planted grass to keep moist and in a healthy growing condition. The contractor is to water and fertilize as needed to keep the turf in a vigorous healthy condition.

8. The contractor is to protect the newly sodded area from foot traffic as needed. The contractor is to continuously resod and repair damaged areas as required.

3.5 STAKING AND TYING

A. Remove nursery stakes and ties.

B. Install tree stakes 18" deep on windward and leeward sides of tree and tie to tree with 4 ties. Install ties loose enough to avoid injuring cambium layer of tree and to allow limited movement.

C. Remove nursery ties from shrubs and espaliered plants and install new plastic ties in a loose manner so new plant growth will not girdle the branch or stem.

3.6 MAINTENANCE

A. Maintain planted areas during the progress of the work and through the maintenance period. A minimum of one trained workman shall be on the site 4 hrs per day after planting until the fourth mowing and as needed through the maintenance period.

B. The maintenance period begins when the work is substantially completed and accepted by the Owner. The turf areas are to be completely planted and show active growth and reasonable coverage before the specified maintenance period can begin. The maintenance period shall be for one hundred twenty days (120) days, after substantial completion by the Owner. The Owner and Landscape Architect shall be notified a minimum of 10 days prior to the time that the work is ready for final inspection. This final inspection is required before the maintenance period can begin. The contractor is responsible to provide all materials and labor to maintain the site for the maintenance period at no cost to the Owner. The maintenance period may be extended at no cost to the Owner should prevailing site conditions not warrant final acceptance by the Owner. The site should be in a weed free condition, the lawns should be established, vigorous, have minimum 99% coverage, be weed free, and fertilized, and all plants and trees are to be in good condition. The maintenance period will be extended in one month increments until the Contractor brings the site into compliance

at no additional cost to the Owner.

C. During the maintenance period the contractor shall provide the following services, but is not limited to the services outlined below.

1. Maintain surfaces and supply additional top soil where necessary, including areas affected by erosion.

2. Water to ensure uniform turfgrass growth and to keep surface of soil damp. Fertilize as specified on a monthly, or as needed basis.

3. Apply water slowly so that surface of soil will not puddle and crust.

4. Maintain turf & planted areas weed free. Hand weed or use chemicals at the Contractor's option.

5. Mow and maintain the turf areas, and pick up grass clippings to be hauled off site at the Contractors expense.

3.7 CLEAN-UP

A. Remove rubbish, trash, and debris resulting from the operation at the end of each working day.

B. Wash paved surfaces clean.

C. Maintenance period will begin with acceptance of installation by the Owner and will continue as noted in article 3.06.

3.8 EXTRA LANDSCAPE MATERIALS

A. Contractor shall supply the following extra materials to be installed at the direction of the Landscape Architect during the project at any time. Each item is to include all associated materials (landscape and irrigation) and all appurtenances associated with the item, including material, labor and equipment costs for a complete installation in accordance with the project documents at no additional cost to the Owner. Should any items not be installed as part of the project, the remaining items are to be delivered to Owner or a credit issued at the Owner’s option as part of the project completion documentation.

1. Three (3): One gallon size plants (Variety to be determined in the field)
2. Three (3): Five gallon size plants (Variety to be determined in the field)
3. Three (3): Fifteen gallon size trees (Variety to be determined in the field)

All work is to be in compliance with all project specifications and construction details at no additional cost to the Owner.

END OF SECTION 32 8400

SECTION 33 4000 - STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide storm sewage system where shown on the drawings, including pipe, manholes, cleanout and inlet structures, placing and compacting pipe bedding, final backfilling, compaction and grading. As specified herein, and as needed for a complete and proper installation.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications.
2. Contractor shall comply with the City of Fresno Standard Drawings and Specifications, published January 2023, wherever noted on the plans.
3. Section 01 5000: Temporary Facilities and Controls.
4. Section 01 5725: Storm Water Pollution Protection Plan.
5. Section 01 7330: Cutting and Patching.
6. Section 31 2000: Earthwork.
7. Section 32 1210: Asphaltic Concrete Paving.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 3300.
1. Product Data: Submit manufacturer's descriptive literature and product specifications for each product. Include data to indicate compliance with the specified requirements. Provide Certificates of compliance for material.
2. Installation Procedures: Submit manufacturer's recommended installation procedures.
3. Manufacturer's Installation Instructions: Indicate special procedures required to install products supplied.

1.3 QUALITY ASSURANCE

A. All improvements within property owned by a City, County or State Entity shall be in accordance with the Standard Specifications of the authority having jurisdiction.

1.4 COORDINATION

A. Verify that the location of existing utilities have been indicated at work site by utility authorities and the Owner.

1.5 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 locations, 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.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Storm drain piping shall be reinforced concrete pipe (RCP), polyvinyl chloride pipe (PVC), or high density polyethylene pipe (HDPE), unless a piping material is specifically designated on the Drawings.

2.2 REINFORCED CONCRETE PIPE MATERIALS

A. Reinforced Concrete Pipe (RCP): ASTM C76; bell-and-spigot ends and gasketed joints with ASTM C443 rubber gaskets; appropriate pipe class shall be determined by the depth of cover listed below unless noted otherwise on the Drawings.
   1. Class III, Wall B minimum for cover depths from 2 feet to 3 feet.
   2. Class II, Wall B minimum for cover depths greater than 3 feet up to 9 feet.
   3. Class III, Wall B minimum for cover depths of greater than 9 feet up to 14 feet.
   4. Class IV, Wall B minimum for cover depths of greater than 14 feet up to 20 feet.
   5. Class V, Wall B minimum for cover depths greater than 20 feet up to 30 feet.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

C. Flexible Watertight Joints: Rubber compression gasket joints, ASTM C443.

2.3 POLYVINYL CHLORIDE PIPE MATERIALS

A. Polyvinyl Chloride Pipe: ASTM D3034, SDR 35, Type PSM; bell and spigot style joint end.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

C. Flexible Watertight Joints: Provide rubber type gaskets for PVC pipe; ASTM 3212.

2.5 DRAINAGE STRUCTURES

A. General: Construct manholes, inlets, and junction structures of reinforced concrete or precast reinforced concrete, complete with metal frames and covers or gratings, and with fixed ladder rungs, and mortared joints where indicated on the Drawings.

B. Concrete: 2500 psi reinforced concrete as specified in Section 03 3000, unless otherwise noted on the Drawings.

C. Mortar for pipe joints and connections to other drainage structures, and manhole construction:
   1. ASTM C270, type M, except the maximum placement time shall be one hour.

2. Hydrated lime complying with ASTM C141, type B, may be added to the mixture of sand and cement in an amount equal to 25% of the volume of cement used.
3. Provide a quantity of water in the mixture sufficient to produce a stiff workable mortar, which shall be clean and free from harmful acids, alkalis, and organic impurities. Use the mortar within 30 minutes after water is added to the mix.

D. Frames, Covers, and Gratings: Cast iron; ASTM A48, Class 25.:
1. Provide all gratings or covers from the same manufacturer.
2. Provide ADA compliant grates where located in walking surfaces; with spaces no greater than 1/2" wide in one direction. Orient elongated openings perpendicular to dominant direction of travel.

E. Precast Reinforced Concrete Manhole Sections: ASTM C478; resilient connectors, ASTM C 923; elliptical single line reinforcement is not allowed unless shown on detail drawing.

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.

B. Identify location of proposed storm drainage facilities to be constructed. Expose connection points to existing system. Locate, identify, and protect existing above and below grade utilities from damage. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.

C. Employ equipment and methods appropriate to the work site. 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. Remove all interfering surface and subsurface improvements authorized for removal.

D. PROVIDE WATER AND WATER TRUCK OR OTHER METHODS OF MITIGATING EXCESSIVE DUST ON THE SITE. KEEP SITE DAMP ENOUGH TO MINIMIZE POWDERING DIRT AND AIRBORNE DUST.

E. Comply with Public Works Standards of the governing jurisdiction or these specifications, whichever is more stringent.

3.2 EXCAVATING, TRENCHING, AND BEDDING

A. Excavate, trench, and bed for site drains in accordance with pertinent provisions of Section 31 2000.

3.3 PIPE INSTALLATION

A. General:
1. Carefully examine each pipe prior to placing.
   a. Promptly set aside defective pipe and damaged pipe.
   b. Clearly identify defects.
   c. Do not install defective pipe or damaged pipe.
   d. Install the pipe and fittings to the lines and grades shown on the construction plans.
2. Place pipe to the grades and alignment indicated, with a tolerance of one in 1000 vertical and one in 500 horizontal, unless otherwise directed by the Architect.
3. Provide adequate facilities for lowering pipe safely into the trenches.

B. Install pipe and fittings in accordance with the manufacturer's recommendations, and these specifications.
   1. Unless otherwise approved by the Engineer, lay all pipe upgrade from structure to structure, with bell or socket ends of pipe upgrade.
   2. 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.
   3. Ensure that all joints are properly "homed" and are watertight.
   4. Bed concrete pipe in sand envelope, and compact. Place and compact the bedding material under, around and over the pipe, filling the trench cavity and extending from the bottom of the trench (6" below the outside bottom of the pipe barrel) to a level 12" above the outside top of the pipe barrel.
   5. Do not place pipe in water, nor place pipe when trench or weather is unsuitable for such work.

C. High Density Polyethylene Pipe Installation: Installation shall be in accordance with ASTM 2321-89.

D. Utility Identification Tape:
   1. Provide metallic plastic caution ribbon in trench approximately 12" above the top of the pipe indicating "CAUTION STORM SEWER".
   2. Run ribbon continuous from inlet or manhole to each vertical structure.

3.4 DRAINAGE STRUCTURE INSTALLATION

A. Install drainage structures in accordance with the Drawings and with the manufacturer’s written installation instructions.

B. Form bottom of excavation clean and smooth to correct elevation.

C. Level top surface of base pad; sleeve concrete shaft sections to receive pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.5 MANHOLE INSTALLATION

A. Place concrete base pad, trowel top surface level.

B. Place pre-fabricated manhole sections plumb and level, trim to correct elevations, anchor to base pad.

C. Form and place cast-in-place manhole cylinder plumb and level, to correct dimensions and elevations. As work progresses, build in fabricated metal items.

D. Cut and fit for pipe.

E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

F. Set cover frames and covers level without tipping, to correct elevations.

G. Coordinate with other sections of work to provide correct size, shape, and location.

3.7 BACKFILLING

A. Backfill and compact in accordance with pertinent provisions of Section 31 2000.

3.8 TESTING AND INSPECTING

A. Provide personnel and equipment necessary, and perform tests required to demonstrate that the work of this Section has been completed in accordance with the specified requirements.

B. Hydrostatic Test on Watertight Joints:
   1. Test joints within the building area and outside the building area but within ten feet of exterior walls or faces of the buildings.
   2. Make a hydrostatic test on each watertight joint. Test one sample of each type watertight joint used. If one sample fails because of faulty workmanship, test an additional joint.
   3. Demonstrate that joints in reinforced and unreinforced concrete pipe comply with ASTM C443-01.
   4. Comply with ASTM C425 for tests of joints in clay pipe.
   5. Make tests in concrete pipe at an internal hydrostatic pressure of 10 psi for 24 hours.
   6. Replace or repair joints found to be faulty. Repeat the test and repair cycle until joints are demonstrated to meet the specified requirements.

END OF SECTION 33 4000